

UNITED STATES PATENT AND TRADEMARK OFFICE

---

BEFORE THE PATENT TRIAL AND APPEAL BOARD

---

HOWARD INDUSTRIES, INC.

Petitioner,

v.

CAPSA SOLUTIONS LLC

Patent Owner.

U.S. Patent No. 7,594,668

Filing Date: August 18, 2008

Issue Date: September 29, 2009

U.S Patent No. 8,215,650

Filing Date: July 20, 2011

Issue Date: July 10, 2012

---

Case Nos. IPR2023-01274, IPR2023-01275

**DECLARATION OF PINHAS BEN-TZVI IN SUPPORT OF PATENT  
OWNER'S PRELIMINARY RESPONSE TO '668 AND '650 IPR  
PETITIONS**

I, Pinhas Ben-Tzvi, declare as follows:

**INTRODUCTION**

1. I have been retained by Plaintiff Capsa Solutions LLC (or "Capsa") as an independent expert for the above-identified inter partes review proceeding

involving U.S. Patent Nos. 7,594,668 (“the ’668 Patent”) and 8,215,650 (“the ’650 Patent”) (collectively, “the Patents-at-issue”).

I have personal knowledge of the facts stated herein, unless stated otherwise, and I would testify truthfully to those facts if called as a witness.

## **BACKGROUND AND QUALIFICATIONS**

2. I received a BS degree in Mechanical Engineering (Summa Cum Laude) from the Technion - Israel Institute of Technology in 2000, a Master’s degree in Mechanical Engineering from the University of Toronto in 2004, and a Ph.D. degree in Mechanical Engineering from the University of Toronto in 2008. Attached to this Declaration, as **Exhibit 1**, is a true and correct copy of my curriculum vitae (CV). I have authored numerous technical books and articles in the field. *See Exhibit 1*, CV. I’ve authored over 180 peer-reviewed articles in the field of engineering design and various mechanisms. I have also been retained as an expert in support of patent litigation. *See, Exhibit 2*, list of cases. I have prior expert witness experience, written expert reports, and testified in depositions, IPR and ITC proceedings related to patent infringement cases and validity issues also related to medical equipment.
3. I am currently a Professor in the Department of Mechanical Engineering at Virginia Tech University, Blacksburg, Virginia. I am a tenured Professor of Mechanical Engineering and Electrical and Computer Engineering, and

Founder and the Director of the Robotics and Mechatronics Lab at Virginia Tech. I am also a licensed Professional Engineer (P.E.).

4. I am currently also a Program Director for the Established Program to Stimulate Competitive Research (EPSCoR), Office of Integrative Activities (OIA), Office of the Director (OD), National Science Foundation (NSF), Alexandria, VA on an Intergovernmental Personnel Act (IPA) assignment as detail to NSF. My views in this declaration are my own, and do not represent the NSF in any way or form.
5. I am the named inventor on at least twelve U.S. patents and patent applications and a Canadian patent directed to various electromechanical devices.
6. My expertise includes mechatronics, robotics, automated control systems and automation, mechanical design, mechanism design, machine design, and product development and integration. I have additional knowledge in mobile robotics for military and police applications, human-robot interaction, microprocessor-based applications, and computer aided design (CAD).
7. In my many years of engineering, manufacturing, and product development experience, I have personally been involved in the design of many types of mechanical products, including many designs using drivers (e.g., gas pistons or springs, hydraulic drivers, electro-mechanical drivers/linear actuators). I am intimately familiar with the technology, and concepts utilized in the

products at issue in this case. In my experience, I have seen the importance of understanding how a product will be used and how chosen performance features will determine the predominant final product application.

8. I am an experienced mechanical/electromechanical design engineer and technical expert with extensive experience with various types of drivers, linear motion control, and ergonomic industrial design. I have over 23 years of combined industrial and academic experience in mechanical design, testing, prototyping, developing, and machine/mechanism design, synthesis, analysis, manufacturing and integration. I have industrial experience working for General Electric Medical Systems and other companies in product development that involved the use of height adjustment mechanisms that use drivers for various medical equipment. At General Electric Medical Systems, I designed and integrated various devices and related electronic components including height adjustment mechanisms and drivers used in conjunction with the development of two-degrees-of-motion beds for PET, CT and MRI machines.
9. I also teach courses at Virginia Tech in electro-mechanics that involve the design and construction of various drivers, actuators and linear motion control. I also frequently use and design drivers and linear motion control components in development of prototypes as part of my ongoing academic

research funded by a variety of government agencies.

## **MATERIALS CONSIDERED**

10. In forming my opinions, I have reviewed documents cited in the Petitioner's IPR Petitions to the '668 and '650 Patents. The descriptions of the '668 and '650 Patents are the same and the claims at-issue from the '650 and '668 Patents have the same dispositive limitations not found in the cited references. Therefore, citations to '650 and '668 Patent descriptions are used interchangeably herein.

11. I have also reviewed and considered documents cited in Patent Owner's Preliminary Responses to the Petitioner's IPR Petitions to the '668 and '650 Patents.

## **SUMMARY OF ARGUMENT**

12. The claimed invention provides a mobile medical cart station with enhanced ergonomics for nurses and other medical staff. *E.g., '650 Patent, Abstract.* Prior to the '650 and '668 patents, no one in the industry had invented a mobile medical cart with height adjustable compartments and work surface(s) as part of a unified, compact work platform as recited in the claims at-issue or knew how to realize the same. *See '668 Patent, claims 3, 4.* Although carts with height adjustable work surfaces and keyboard trays (e.g., workstations for computers) were known, these known carts lacked enclosed compartments

that were also adjustable in height. Because these carts have to be mobile and light enough for nurses to easily move them around a hospital, nobody in the industry, prior to the '668 and '650 Patents, knew how to integrate relatively heavy compartments, and stored items within them, into a height adjustable work platform without sacrificing mobility, stability and weight constraints. In other words, the prior art carts did not have the stability to support relatively heavy compartments into a height adjustable workstation, especially if the compartments were raised up to higher positions – they would be prone to toppling over from the top-heavy weight arrangement.

13. The inventors of the '668 and '650 Patents were the first to use the height adjustment mechanism as support for a compact work platform *including compartments*, allowing the compartments to be adjustable in height so nurses and other healthcare providers do not have to constantly bend over to obtain items stored in the compartments. The inventors of the '668 and '650 Patents were also the first to realize such a cart by placing the height adjustment mechanism at a rear of the work platform of the cart, thereby freeing up space for compartments to be “*disposed in* the portion of the work platform projecting from the height adjustment mechanism in the forward direction” as recited in the claims at issue. Configuring the inventive cart in this specifically claimed fashion allows the cart to be more compact with a lower

center of gravity unlike the top-heavy carts of the Clark and Reeder references relied upon by Petitioner which, especially if modified as proposed by Petitioner, would result in an unstable and especially top-heavy configuration. The Patent Office agreed with this reasoning during the prosecution of the related '650 Patent in overcoming the Clark reference.

14. Contrary to the conclusory allegations made by Petitioner, the Petition fails to raise a *prima facie* case of obviousness as none of the cited references, including the primary references of Clark and Reeder, teach or suggest all of the limitations of the claims at-issue, because no articulated reasons are provided as to why a PHOSITA would modify the cited references to reach the claimed inventions, and because there would be no reasonable expectation of success in modifying the primary reference of Clark and Reeder as proposed. For example, Petitioner provides no reasons as to why a PHOSITA would modify the carts of Clark or Reeder to dispose compartments in a forward-projecting portion of the height adjustable work platform or any evidence that there would be a reasonable expectation of success in this regard – instead mistakenly assuming that these references teach such claim elements.

15. Additionally, the Petition should be denied because the Petitioner makes substantially the same arguments made and overcome during the prosecution

of the related '650 Patent. As discussed in more detail throughout this response, the Clark reference was effectively cited during prosecution and was overcome. (Clark is cited on the face of the '668 Patent and an equivalent<sup>1</sup> was discussed and overcome during prosecution of the related and co-challenged '650 Patent.) Top-heavy carts of Clark (and now Reeder) were overcome during prosecution because the Examiner agreed that a PHOSITA would not be motivated to modify the already top-heavy cart of Clark to make it even more top-heavy by adding additional components (*e.g.*, pivotable trays) to the work platform because the carts modified in this manner would be more unstable and would not work for their intended purposes (*e.g.*, they would be more susceptible to toppling over from the extra weight).<sup>2</sup> This is a distinction argued before the Office with regard to Clark in the related and co-challenged US Pat. No. 8,215,650 – an argument the Office rightfully agreed with. *See e.g.*, Ex. 2003, OAR of 3/28/2012 in '650 Patent File History at pgs. 8-12. For example, the Applicant of the Patents-at-issue argued in

---

<sup>1</sup> Ex. 2002, US Pat. 6,721,178 to Clark, which is a continuation of the Clark reference cited by Petitioner. The claims at issue in the '650 IPR Petition filed concurrently with this '668 IPR are substantially similar to the claims at issue from the '668 Patent. Thus, the arguments made in the '668 IPR are very similar to the arguments made in the '650 IPR. For example, the only independent claim at issue in the related '650 Patent also recites limitations to a cart having a height adjustable work platform, including compartments, where the compartment(s) are disposed in a forward projecting portion of the work platform. '650 Patent, claim 1.

<sup>2</sup> Because the inventive cart of the '650 and '668 patents have a different center of gravity, it can support a heavier work platform that may also include extendable work surfaces and compartments.

overcoming Clark:

For example, if one of ordinary skill in the art had tried to incorporate the pivotal trays 48, 50, and 52 of Ellefson into the workstation of Clark, the resulting workstation would be top heavy if the tray were deployed. The result is that the deployed trays would make the workstation of Clark unstable so that it would be easily knocked over. The reason that the pivotal trays can work in the tool chest of Ellefson is that a tool chest contains heavy tools so as to prevent instability, a condition that is lacking in Clark. In other words, the overall design of the tool chest of Ellefson (including its lower center of gravity) permits the use of pivotal trays while the workstation of Clark (with its higher center of gravity) does not. Accordingly one of ordinary skill in the art would not combine the teachings of Clark, Rice, and Ellefson so as to arrive at a height-adjustable work platform with a movable work surface located above a compartment...Similarly, one of ordinary skill in the art would not have had reason to incorporate any particular feature on Murphy into the workstation of Clark because Murphy is designed to be low to the ground...and modifying the workstation of Clark (with its higher center of gravity) based on the teachings of Murphy would likely make the resulting workstation top heavy such that it would be easily knocked over. Id at 10.

*Id.* (emphasis added). The claims were subsequently allowed by the Examiner. *Id.*, see Notice of Allowance.

16. The Petitioner now similarly argues that the '668 and '650 Patents are obvious in view of the workstation of Clark if modified by adding alleged compartments into the height adjustable workstation of Clark. As discussed, the proposed combination of Clark plus the pivotal trays and other components from Ellefson/Murphy were overcome during prosecution because such a combination would be excessively top-heavy and unstable. Thus, Petitioner makes substantially the same arguments that were overcome

during the prosecution of the related '650 Patent (i.e., Petitioner' argument merely substitutes wire trays and storage bins and other alleged compartments for the pivotal trays and other features of Ellefson/Murphy in arguing for obviousness.) The Petition fails to reasonably distinguish the Examiner's prior consideration of Clark, and Reeder is, in pertinent part, substantially the same as Clark. The remaining references (at least one (Santoro) of which is also of record in the '668 Patent), while still suffering from deficiencies, are cited by Petitioner for other reasons and do nothing to cure these fundamental distinctions.

17. None of Petitioner's cited references teach or suggest at least one element that is found in each of the independent claims of the subject patent, namely: "the compartments are disposed in the portion of the work platform that projects from [or relative to] the height adjustment mechanism in the forward direction". As properly defined, Petitioner's cited primary references do not have enclosed compartments at all. Even if a broad interpretation is given to compartments, the carts in Petitioner's references do not dispose the alleged compartments in a portion of an alleged work platform projecting forward from an alleged height adjustment mechanism, instead placing them rearward of the alleged height adjustment mechanism. And, even if modified as proposed by Petitioner, would provide a particularly top-heavy configurations

subject to toppling.

18. Challenged claims 3-4 of the '668 Patent and claims 1-3, 5-6, and 8 of the '650 Patent were rightfully allowed by the Office. Nothing provided or argued by Petitioner should disturb the USPTO's correct decision to issue the '668 and '650 Patents. For these and other reasons more fully set forth herein, Petitioner fails to carry its burden or presenting a reasonable likelihood of prevailing on its challenge against either of claims 3-4. Therefore, the Office should deny institution of the requested *inter partes* review.

## **BACKGROUND**

19. I have read the "Background" sections of the Patent Owner's Preliminary Responses to the Petitioner's IPR Petitions to the '668 and '650 Patents and agree with the statements made in this section.

## **LEGAL STANDARDS**

20. I have read the "Legal Standards" sections of the Patent Owner's Preliminary Responses to the Petitioner's IPR Petitions to the '668 and '650 Patents and have adhered to those standards in rendering my opinions. I have read the "Legal Standards" sections of the Declarations of Mr. Ronald B. Kemnitzer in support of Petitioner's IPR Petitions to the '668 and '650 Patents discussing obviousness and anticipation principles, and have adhered to those standards in rendering my opinions, although I do not agree with the conclusions and

opinions of invalidity of Mr. Kemnitzer.

## **LEVEL OF ORDINARY SKILL IN THE ART**

21. A PHOSITA in the 2003-2004 timeframe of the '668 and '650 Patents would have had a bachelor's degree in a pertinent discipline involving mechanical product design, such as mechanical engineering, with 2-3 years of experience in in the design, manufacture, or analysis of mechanical devices. Alternatively, a POSITA would have been a person with a 2-year mechanical engineering diploma and had 4-6 years of experience in in the design, manufacture, or analysis of mechanical components and devices.

22. Petitioner submits a somewhat different, and broader, definition. '668 Petition at pg. 7. The difference is notable particularly as it supports fields, such as industrial design, that do not require the same level of hard sciences as Patent Owner's definition. In this regard, Petitioner's supplied expert testimony from Mr. Kemnitzer comes from an industrial designer. Mr. Kemnitzer's background and qualification, while notable in his own field, fails to meet Patent Owner's definition for a PHOSITA. Mr. Kemnitzer's education and experiences are in industrial design. While the field of industrial design does not have a set definition, the field is generally more directed toward aesthetic design and, at best, high-level functionality, rather than hard science type mechanical engineering, physics, and detailed

implementation considerations. This distinction in background is borne out in the insufficiency of Mr. Kemnitzer's analysis as further explained herein. As further explained herein, considerations of physics and/or mechanical engineering are at the core of at least several important reasons why the claimed invention is patentably distinct over the cited references as further described herein. Therefore, it is my opinion that Patent Owner's definition of a PHOSITA should be adopted. Notwithstanding, the Petition should be denied under either party's definition of a PHOSITA as Petitioner has failed to meet its burden of establishing a *prima facie* case of obviousness.

23. I understand that I must evaluate the '668 and '650 Patents from the perspective of a person of ordinary skill in the art. That is, the '668 and '650 Patents must be evaluated through the eyes of a person with ordinary skill in the relevant art at the time of the invention of this patent.

24. Based on my educational background and experience, I am qualified as at least a person of ordinary skill in the art with respect to the '668 Patent and 650 Patents. I am familiar with the knowledge of the person of ordinary skill in the art at the time of inventions of the '668 and '650 Patents. I am able to opine on how a person of ordinary skill in the art would have understood the patent descriptions and claims of the Patents-at-issue, the descriptions of the prior art, the motivation to combine the prior art, and what combinations

would have been obvious and not have been obvious to one of ordinary skill in the art.

## CLAIM CONSTRUCTION

25. I have read the “Claim Construction” section of Patent Owner’s Preliminary Responses to the Petitioner’s IPR Petitions to the ’668 and ’650 Patents and have adhered to those guidelines in rendering my opinions. I agree with Patent Owner’s contention that the claimed invention is valid under any reasonable construction as the Petitioner has failed to establish a *prima facie* case of obviousness or anticipation as set forth herein.

## THE CLARK REFERENCE

26. Figure 2B shown here is an annotated figure from Clark showing a side view of the cart of Clark

with the entire workstation with keyboard tray 12 mounted on top of the center height adjustment mechanism resulting

Thus, even if the opening for the keyboard tray 12 in Clark is considered a “compartment” it is disposed *outside* a forward-projecting portion of the workstation (the annotated red oval indicates a rear-facing portion of the workstation that the keyboard cavity is located).

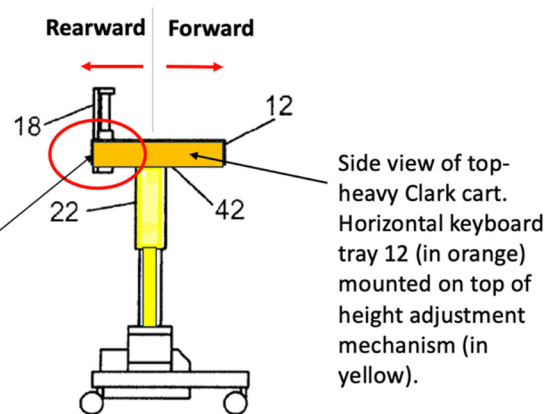


**Fig. 2B**

in the keyboard tray/cavity being disposed *outside* a forward-projecting

portion of the workstation. In other words, even if the keyboard tray/cavity of Clark is considered a “compartment”, it is mounted on top of the centrally located height adjustment mechanism and clearly extends rearward of the height adjustment mechanism (*i.e.*, it is located *outside* a portion of the alleged work platform that projects from [or relative to] the height adjustment mechanism in the forward direction). The configuration of Clark results in a more top-heavy design compared to the invention of the ’650 and ’668 patents. Thus, Clark fails to teach or suggest all of the claimed embodiments, alone or in combination.

27. Reeder is generally directed to a patient monitoring cart/system. *E.g.*, Abstract. While a large number of embodiments are provided in Reeder, only a select few are relied upon by Petitioner. *E.g.*, ’668 Petition at pg. 46-48, ’650 IPR Petition at pgs. 57-59 (citing embodiments of figure 31, 45-46). The embodiments relied upon by Petitioner teach open top wire bins or open storage bins attached the center support column as opposed to enclosed compartments. *E.g.*, Reeder, figure 31, 45-46. These components are not disposed in the workstation/work surface portion as required by the claims. *E.g.*, *id.* Other embodiments utilize drawers but are not height adjustable, presumably for stability reasons. *E.g.*, Reeder, figure 32-33. Exemplary figures from Reeder (annotated with color) are reproduced below for

reference (showing work surface/workstation in orange and height adjustment mechanism in yellow). As illustrated, there are no enclosed compartments disposed in the height adjustable workstation of Reeder.

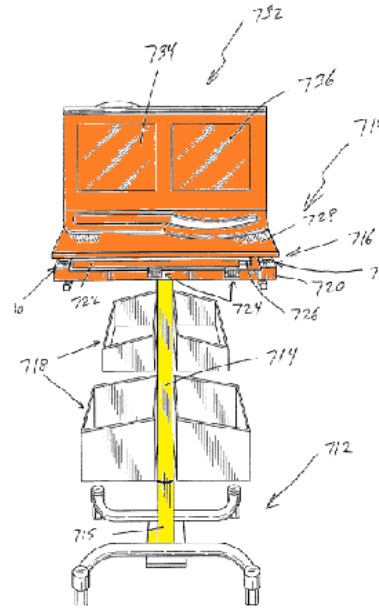
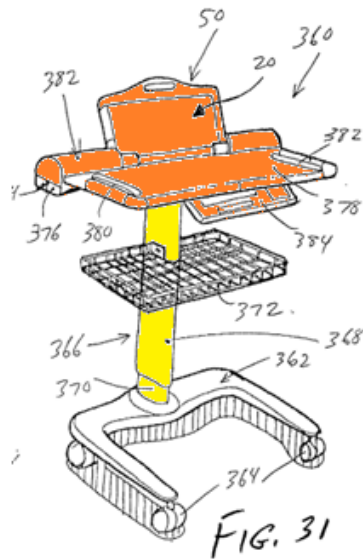
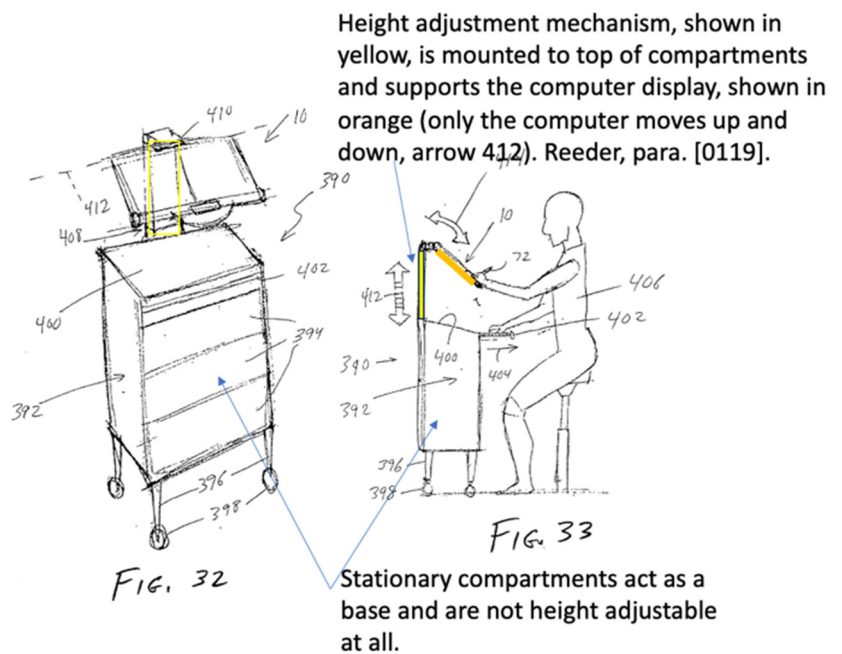


Fig. 45

Again, the cart of Reeder, like Clark, is inherently top-heavy because it is also configured with a workstation mounted entirely on top of the centrally located height adjustment mechanism. See Reeder, paras. [0118], [0147]-[0148] (describing “center” vertical support member 714 with workstation 710 mounted entirely to the top of the center height adjustment mechanism). Because Reeder teaches an already top-heavy cart, Reeder does not teach or suggest disposing additional enclosed compartments into the height adjustable workstation or explain how doing so could be accomplished. For example,

the above carts of Reeder merely teach wire trays or side bins<sup>3</sup> attached to the center support (i.e., they are not “disposed in” anything, much less in a height adjustable work platform as claimed). Thus, the ‘668 and ‘650 Patents solve this top-heavy problem that the



inventors of Reeder did not solve (e.g., how to put compartments (assessible from the front of the cart), loaded with stored items, as part of the height adjustable work platform while maintaining mobility and stability of the cart). Additionally, the wire tray and side bins of Reeder hang off the side of the center support (and towards the rear of cart) and thus are not “disposed in” a forward-projecting portion of a work platform as claimed. The only carts with compartments described in Reeder (embodiments of Figures 32, 33 of Reeder reproduced here) utilize the compartments as the base of the cart that does not

<sup>3</sup> Again, as previously discussed, the ‘668 and ‘650 Patents distinguish side bins from enclosed compartments that are disposed in the work platform.

adjust up and down in height at all. Thus, Reeder teaches the exact opposite of what the '650 and '668 patents teach and fails to solve the same problems in the art. Instead, in this embodiment, the height adjustment mechanism of Reeder is supported by the compartments and not the other way around as provided by the inventive carts of the '668 and '650 Patents. See arrow 412 in Figures 32, 33 of Reeder, Reeder at para. [0119]. In other words, the compartments of Reeder are not projecting forward from anything (instead, they serve as the base unit). Thus, the embodiments of Figures 32, 33 of Reeder do not teach or suggest the claim limitations of the compartments of a work platform being *disposed in* the portion of the work platform that projects from [or relative to] the height adjustment mechanism in the forward direction (again, the alleged compartments of Reeder are separate from a height adjustable work platform and not disposed in it at all, much less in the forward-projecting space as recited). Reeder provides further evidence that at the time of filing of the '668 and '650 Patents at-issue, no one in the industry had incorporated enclosed compartments into a height adjustable work platform or knew how to accomplish it.

#### **CLARK FAILS TO TEACH OR SUGGEST ANY COMPARTMENTS**

28. Petitioner relies on an open, keyboard tray cavity of Clark as allegedly providing the “compartment(s)” of the challenged claims. *E.g.*, '668 IPR

Petition at pg. 24 (citing figures 4A-4B). This open keyboard tray cavity does not meet the definition for the “compartment(s)” as “an enclosed space for containing an item”. Clearly, this open cavity of Clark is not enclosed. Additionally, the keyboard cavity of Clark is not provided for the purpose of separately storing medical items as intended by the ’668 and ’650 Patents, *e.g.*, medications and medical supplies, because it is already occupied by a pull-out keyboard tray 70, 424 and computer keyboard.

29. While Clark makes an unclear and passing, reference to supporting a docking station 18 by a drawer or pull-out tray, the details are vague, hypothetical, and aspirational.<sup>4</sup> *E.g.*, ’668 IPR Petition at pg. 24, ’650 IPR Petition at pg. 22-23 (citing col. 10 ll. 30-33 of Clark). The drawer in question is not illustrated or described in any detail. *See id.* It is my understanding that aspirational and hypothetical references without any data or explanations or why or how the claimed limitations could be accomplished would be dismissed by a skilled artisan. Contrary to the conclusory allegations of Petitioner, the Clark reference never states that the opening/cavity for the keyboard tray 70 can be “*converted*” to a drawer. *See Id.* Notwithstanding, a PHOSITA would not

---

<sup>4</sup> For example, the docking station 18 supports a wireless computer terminal 20 which is displayed to the user, yet it is unclear why or how such a docking station would be placed into a drawer or how this would be accomplished. Clark describes the computer terminal 20 as being a wireless, removable computer – essentially, a tablet or laptop. *E.g.*, figures 3A-3D, col. 9 ll. 11-50, col. 10 ll. 51-64.

be motivated to make such a modification to the keyboard cavity of Clark as such a modification would render the Clark reference unsatisfactory for its intended purpose, *i.e.*, converting the keyboard tray cavity to a drawer for supporting a docking station 18 and computer 20 would leave no area for holding the keyboard, and, adding additional drawers to the already-top heavy cart of Clark would cause it to be more susceptible to toppling over. Even if Clark would have taught an enclosed compartment, there is no teaching in Clark that such an enclosed compartment be “disposed in the portion of the work platform that projects from [or relative to] the height adjustment mechanism in the forward direction” as recited in each of the claims at-issue or how this could be accomplished.

30. In view of the foregoing, it is my opinion that Clark fails to teach or suggest the claimed compartment(s).

**CLARK FAILS TO TEACH OR SUGGEST COMPARTMENT(S)  
“DISPOSED IN” A HEIGHT ADJUSTABLE WORK PLATFORM**

31. While Clark makes a vague, passing reference to supporting a docking station 18 by a drawer, Clark does not explain or suggest that such a hypothetical, aspirational, unillustrated and non-enabled drawer be “disposed in” a height adjustable work platform as claimed or how it would be configured or accomplished. *E.g.*, ’668 IPR Petition at pg. 24, ’650 IPR Petition at pg. 22-23 (citing col. 10, ll. 30-33 of Clark), Instead, Clark simply states that such a

hypothetical drawer could be located above or below the tray 12. *Id.* Clark never explains where such a drawer should be attached, how far below the tray, or whether it is disposed in the work platform (or how to accomplish it).

32. On the contrary, as discussed, a PHOSITA would not be motivated to add additional heavy compartments to the already top-heavy workstation of Clark as it would more readily topple over from the extra weight. Thus, even under Petitioner's interpretation, such a drawer would not meet the claim limitations of being "disposed in" a height adjustable work platform. Furthermore, the drawer of Clark would be occupied by the computer terminal 20 of the docking station 18, and thus would not function as a compartment for storing removable items in the sense of the claimed invention. Modifying Clark to the contrary would defeat its intended purpose in this regard. Further still, by describing the location as above or below, a PHOSITA would interpret Clark as providing little, if any, significance to the location when reviewing Clark. This stands in contrast to the challenged claims where the location is important for ergonomics and cart stability. Therefore, Clark fails to teach or suggest compartment(s) disposed within a work platform as required by the challenged claims.

**CLARK FAILS TO TEACH OR SUGGEST COMPARTMENT(S)  
"DISPOSED IN THE PORTION OF THE WORK PLATFORM THAT  
PROJECTS FROM [OR RELATIVE TO] THE HEIGHT ADJUSTMENT**

## **MECHANISM IN THE FORWARD DIRECTION”<sup>5</sup>**

33. Clark fails to teach any purported compartments as being “disposed in the portion of the work platform that projects from [or relative to] the height adjustment mechanism in the forward direction” as required by the challenged claims. ’668 Patent, claims 3-4; ’650 Patent, claim 1. Essentially, this necessarily requires that the height adjustment mechanism be located at a rear of the work platform, or at least sufficiently rearward to accommodate the compartments in a forward-projecting portion of the work platform. However, the alleged height-adjustment mechanism (vertical beam 22) of Clark extends through a middle portion of the alleged compartment (keyboard tray cavity 12), essentially dividing it in half. *See e.g.*, Clark, figures 4A-4B. An annotated version of figure 4B of Clark is reproduced below to illustrate this arrangement.

---

<sup>5</sup> Claim 1 of the related ’650 Patent similarly recites that “the compartment is disposed in the portion of the work platform projecting in the forward direction [relative to the height adjustment mechanism]”. Although, these terms from the ’668 and ’650 Patents are worded slightly different, my opinions contained in this declaration apply equally to the claims at-issue in both the ’668 and ’650 IPR Petitions. That is none of the cited references, including Clark and Reeder, teach compartment(s) disposed in the portion of the work platform projecting from/relative to the height adjustment mechanism in the forward direction.

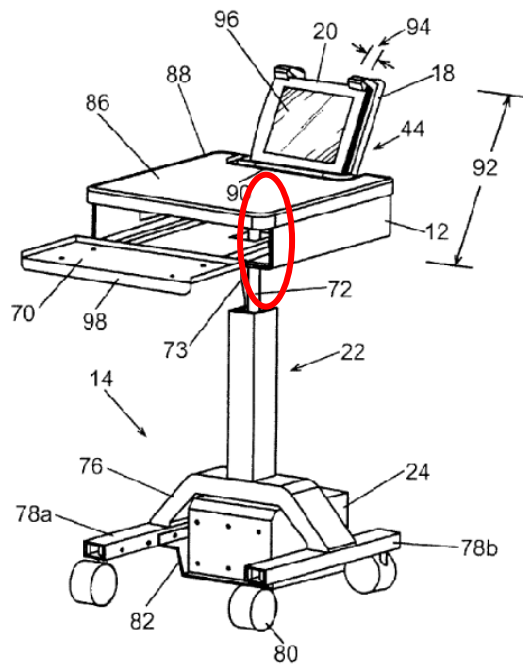
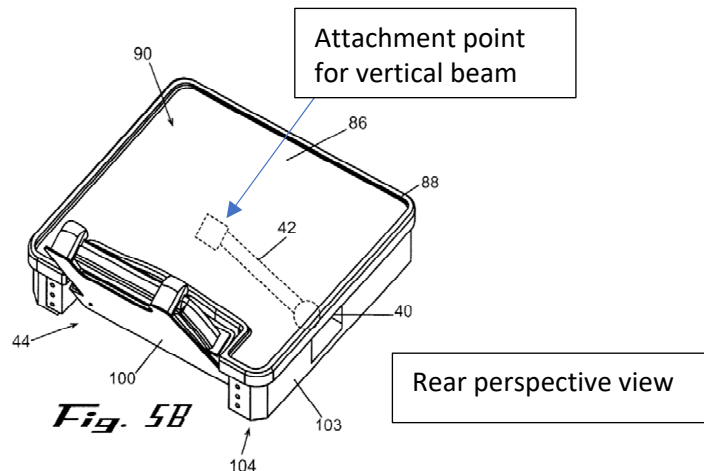
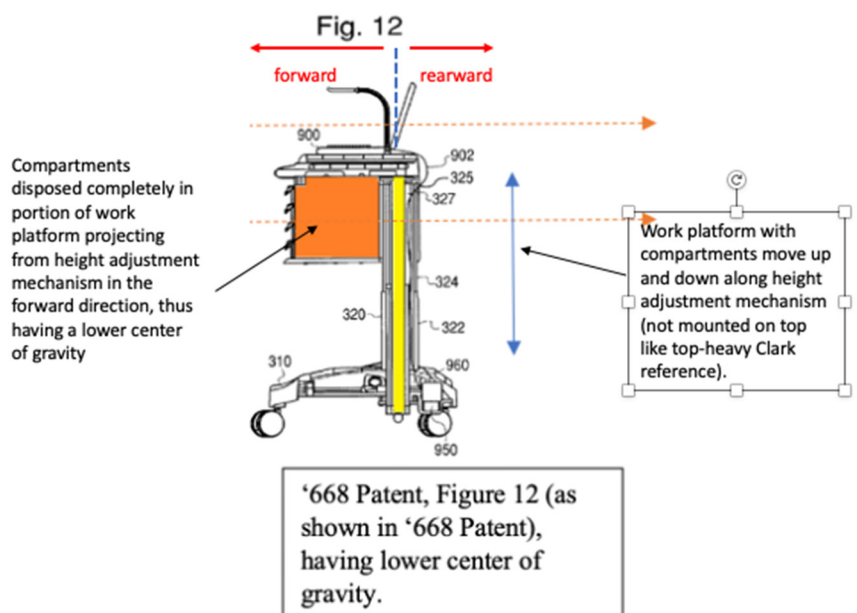


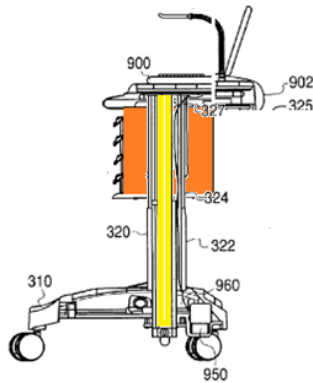
***Fig. 4B***

34. Further illustrating this arrangement, figure 5B of Clark illustrates a release lever 42 contained in the cavity for the keyboard tray extending towards an opening 40 in an outer edge of the tray 12 to permit a user to access the release lever 42 for height adjustment. Figure 5B is reproduced below for reference with annotations.



35. Petitioner incorrectly interprets the teachings of Clark and wrongly assumes that Clark teaches compartments “disposed in the portion of the work platform that projects from [or relative to] the height adjustment mechanism in the forward direction” as required by the claims at issue (relying on a front view of Figure 4A). *See* ’668 IPR Petition, pgs. 30-31, Kemnitzer, at 71-72; ’650 IPR Petition, pgs. 30-31. First, Petitioner takes an unreasonably broad, unsupported and impossible interpretation of this claim term. For example, Petitioner argues that the top-heavy keyboard tray





cavity of Clark meets this limitation even though that cavity extends rearward of the height adjustment mechanism. In an attempt to stretch Clark's teachings to meet the claim limitations, Petitioner essentially argues that a front area (or front pocket of space) of the alleged compartment meets this limitation, thereby essentially dividing the alleged compartment into separate, fractional pockets of space/air. *See Id.* (arguing that the front area/space of the keyboard tray cavity meets this limitation). This is wholly inconsistent with the teachings of the '668 and '650 Patents. First, all embodiments described in the '668 and '650 Patents show that the compartments are disposed only in the portion of the work platform projecting from the height adjustment in the *forward* direction. '668 Patent, Figure 12 (annotated side view here showing no part of the compartments (in orange) extending to the rearward direction from the height adjustment mechanism (in yellow)). In fact, it is impossible for the compartments in the cart of the '668 and '650 Patents to extend to the rearward direction from the height adjustment mechanism because the height adjustment mechanism is in the way (to do this would require a large hole to be bored through the middle of the compartments for the height adjustment mechanism which would prevent access to the compartments, e.g., drawers

could not even be pulled open in such a configuration, see annotated figure shown here). Certainly, the ability to move up and down along the height adjustment mechanism would also be compromised.

36. Additionally, the prosecution history is contrary to Petitioner's broad interpretation of the claims. As discussed throughout this response, the Applicant of the '668 and '650 Patents consistently asserted that a key aspect of the invention is a lower, centralized center of gravity (which as discussed is realized by putting the height adjustment mechanism at the rear of the work platform and disposing the compartments in the portion projecting from the height adjustment mechanism in the forward direction). Again, the Applicant overcame Clark during prosecution because Clark mounts the alleged work platform/compartment centrally, and entirely, on top of the height adjustment mechanism such that the alleged compartment (cavity for keyboard tray) runs an entire length of the work platform from the forward to rear direction, resulting in an inherently top-heavy design which would be further destabilized if modified to meet the claim language. Thus, when construing the claims in view of the intrinsic evidence, the requirement that "the compartments are disposed in the portion of the work platform that projects from [or relative to] the height adjustment mechanism in the forward direction" means that no part of the compartment can be disposed outside of

the forward-projecting portion of the work platform, including in the rearward direction of the height adjustment mechanism.<sup>6</sup>

### 37. Inspection of the side

view of the cart of Clark

illustrates that the alleged

compartment (horizontal

keyboard tray cavity 12

of Clark) is not “disposed

in” a portion of the work

Thus, even if the opening for the keyboard tray 12 in Clark is considered a “compartment” it is disposed *outside* a forward-projecting portion of the workstation (the annotated red oval indicates a rear-facing portion of the workstation that the keyboard cavity is located).

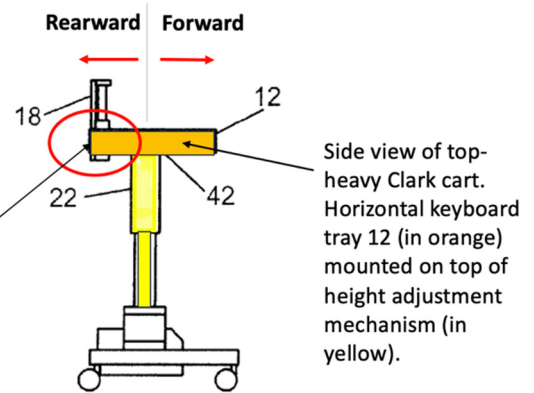


**Fig. 2B**

platform that projects from [or relative to] the height adjustment mechanism

in the forward direction. Figure 2B shown here is an annotated figure from

the Clark patent showing a side view of the Clark cart with the keyboard tray

12 mounted on entirely top of the center height adjustment mechanism. Even

if the keyboard tray cavity of Clark is considered a compartment (which it is

not), it is centrally mounted on top of the height adjustment mechanism and it

runs the entire length (forward to rear) of the cart and thus it is not “disposed

in the portion of the work platform that projects from [or relative to] the height

adjustment mechanism in the forward direction” (i.e., the alleged

compartment of Clark is clearly disposed outside this forward-projecting

<sup>6</sup> In other words, the space that the compartment resides in defines the compartment.

region). Only a front pocket of space/air of the alleged compartment of Clark is found in the forward-projecting space, but the alleged compartment itself is clearly not disposed therein. Thus, Clark fails to teach or suggest all of the claimed limitations, alone or in combination.<sup>7</sup>

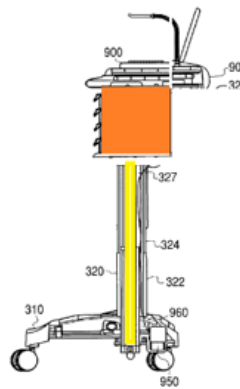
38. Petitioner fails to articulate any basis for why a PHOSITA would be motivated to modify the cart of Clark to include a compartment “disposed in the portion of the work platform that projects from [or relative to] the height adjustment mechanism in the *forward direction*” as claimed. Petitioner mistakenly assumes that Clark teaches this limitation and thus completely fails to articulate a motivation to combine or modify Clark to reach this limitation or explain how there would be a reasonable expectation of success in doing so. See ’668 IPR Petition at 30-32, Kemnitzer, 71-72; ’650 Petition at 30-32. Because Petitioner fails to articulate any reasons for why a PHOSITA would modify Clark to include a compartment disposed in a portion of the work

---

<sup>7</sup> Additionally, on page 33 of the ’650 IPR Petition, in discussing the claimed limitation of the actuator location, Petitioner draws in a red drawer at the bottom of the alleged work platform of Clark, but nowhere in Clark does it state or suggest that the drawer be disposed in this manner or location and nowhere does Petitioner provide any articulated reason why a PHOSITA would make such a modification or that there is a reasonable expectation of success (considering the center support is not located at the rear of the work platform thus providing little room for disposing compartments in a forward-projecting portion). This amounts to conclusory attorney argument. For example, based on the teachings of Clark, this drawer could be placed under the horizontal tray but mounted entirely on top of the center height adjustment mechanism and not disposed in the portion projecting from the height adjustment mechanism in the forward direction. Or a PHOSITA, to maintain stability, could configure the cart similar to Figures 32 and 33 of Reeder where the compartments/drawers are placed as the base of the cart that does not project from the height adjustment mechanism at all.

platform projecting from the height adjustment mechanism in the forward direction as claimed, Petitioner has failed to meet their burden to demonstrate a *prima facie* case of obviousness even if Patent Owner does not provide rebuttal arguments.

39. Again, as previously discussed, there are two main reasons why a PHOSITA would not be motivated to modify the carts of Clark to reach the claimed invention: first, because the entire workstation of Clark is mounted on top of a centrally located support, there is insufficient space to dispose compartments in a portion of the workstation that projects from [or relative to] the center support in the forward direction; and second, because adding heavy compartments to the workstation of Clark would render the cart excessively top-heavy and unstable and prone to toppling over. In other words, the cart of Clark teaches an inherently top-heavy cart (e.g., the height



'668 Patent, Figure 12  
(altered to be top-heavy  
like Clark and Reeder)

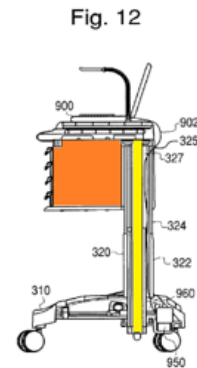


Fig. 12

'668 Patent, Figure 12 (as  
shown in '688 Patent),  
having lower center of  
gravity.

adjustable workstation is mounted entirely to the top of a center support column), and adding heavy compartments to this already top-heavy design would make it even more unstable. Adding compartments to the cart of Clark

would result in a cart that looks like the annotated cart shown here on the left (which is top-heavy compared to the cart of the present invention shown on the right). Thus, not only does Clark fail to teach or suggest such limitations, but a PHOSITA would avoid modifying the top-heavy workstation of Clark with compartment(s) to preserve balance and stability.

40. The Clark reference was similarly overcome during the prosecution of the patents-at-issue in view of other secondary references (like the Ellefson reference) that allegedly taught pivotal trays. *See*, Ex. 2003, '650 file history, Applicant Response and Amendment dated 03/28/2012, pgs. 8-10 (overcoming the Clark reference by stating that a PHOSITA would not modify Clark in this manner because if an additional component (e.g., pivotal tray) was added to the already top-heavy workstation of Clark, it would not work for its intended purpose as it would be more susceptible to being toppled over).
41. Mirroring the arguments made in the prosecution of the related '650 Patent in overcoming Clark, if a PHOSITA had tried to incorporate the heavy compartments into the workstation of Clark, the resulting workstation would be top heavy, particularly when the compartments were deployed, resulting in a workstation of Clark so unstable so that it would be easily knocked over. The compartments can be so located in the cart of the claimed invention because the cart has a lower center of gravity, a condition that is lacking in

Clark. In other words, the overall design of the inventive cart of the '668 and '650 Patents (including its lower center of gravity) permits the use of height adjustable compartments while the workstation of Clark (with its higher center of gravity) does not. Accordingly, one of ordinary skill in the art would not modify or combine the teachings of Clark so as to arrive at a height-adjustable work platform with “compartments disposed in a portion of the work platform projecting from the height adjustment mechanism in the forward direction”. *Id.*

#### **MODIFYING CLARK WITH MANNER WOULD NOT REACH THE CLAIMED INVENTION**

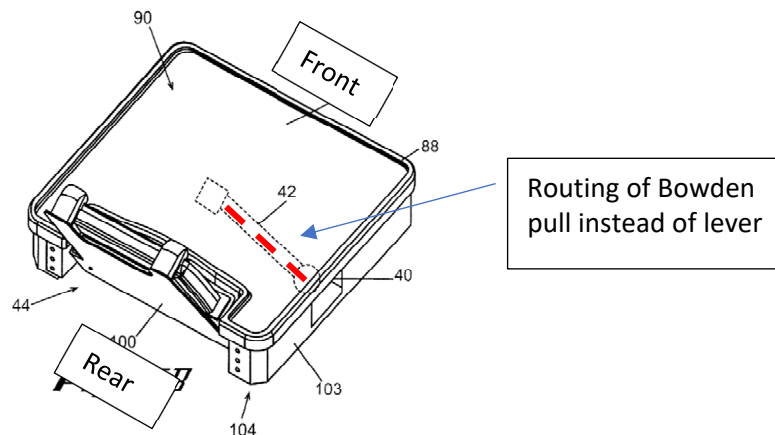
42. Petitioner relies on Manner for the limitation relating to the location of the actuator, thus Manner does not cure the deficiencies of Clark discussed above.

43. The cited passages of Manner at best teaches placing the actuating device 80, and specifically user-interactive grip 82 portion thereof within a holder 83 underneath a “compartment-less” table surface. *E.g.*, '668 IPR Petition at pg. 39, '650 Petition at pgs. 33-34 (citing figure 5, col. 9 ll. 26-28). Indeed, the cited passages state that, “[t]his grip 82 is fastened within a holder 83 that is connected to the underside of the table top 1 and is pivotable in the holder 83.” *Id.* Initially, as Manner fails to teach or suggest compartments, Manner necessarily cannot teach or suggest placing the actuating device, and specifically the grip portion 82 thereof, above any such non-existent

compartments.

44. Nevertheless, Manner at best teaches routing a Bowden pull 81 a column and outward below a next horizontal surface. In this fashion, while it is not clear how Petitioner would modify Clark with Manner, it is clear that incorporating the teachings of Manner into Clark would motivate a PHOSITA to place the alleged actuator below the alleged work platform (the tray 12) of Clark, or at least below the alleged work surface in view of Manner's teachings, rather than above it. Thus, even if Clark's release lever 42 were substituted with the Bowden pull 81 of Manner as asserted by Petitioner, the Bowden pull 81 would remain *within* the alleged compartment of Clark.

45. At best, a "simple substitution" of the release lever 42 of Clark with the Bowden pull 81 of Manner, as proffered by Petitioner, would result in a laterally extending Bowden pull 81 instead of the laterally extending release lever 42. An annotated version of figure 5B from Clark is provided below to illustrate this hypothetical arrangement.



46. There is no specific description in Manner stating that the actuator should be placed above compartments or how doing so could be accomplished. For one, Manner teaches a “compartment-less” table. Petitioner’s heavy reliance on the brief statement in Manner that “[t]he holder 83 can be connected at any desired location to the table top 1 so that the actuating device 80 can be easily activated by the user” is misplaced. ’668 IPR Petition at pg. 51. This brief statement in Manner suggesting a vague, possible modification to the “compartmentless” table of Manner is aspirational at best, and at a minimum is far removed from Petitioner’s specific alleged modifications to the portable workstation of the cart of Clark needed to reach the claimed invention. In other words, Petitioner is essentially arguing that a PHOSITA would be motivated to modify the cart of Clark to place the actuator above compartments based on a proposed modification to the “compartment-less”

table of Manner. A meritless and conclusory assertion.

47. Even still, the addition of Manner does not cure other deficiencies of the primary references of Clark previously discussed. For example, this proposed modification does not cure the failure of the top-heavy cart of Clark to teach the disposing compartments in a portion of a work platform projecting from the height adjustment mechanism in the forward direction as previously discussed.

48. In view of the foregoing, it is my opinion that the addition of Manner does not cure the deficiencies of Clark. At a minimum, these unanswered questions render any combination of Clark with Manner not *prima facie* obvious, easy, and/or a matter of simply rearranging or substituting known components. For at least these additional reasons, it is my opinion that the combination of Clark with Manner does not render the claims obvious.

**DEFICIENCIES IN REEDER: REEDER FAILS TO TEACH OR SUGGEST HEIGHT ADJUSTABLE COMPARTMENT(S)**

49. Reeder fails to teach or suggest height adjustable compartments as the only embodiments of Reeder that include enclosed compartments (e.g., drawers) place the compartments at the stationary base that do not move at all. Reeder, figures 30, 32-33. Petitioner points to various other components of Reeder as the alleged compartments, none of which meet the requirements of the challenged claims (in embodiments of Figures 31, 45-46 of Reeder). More

specifically, Petitioner's citations to the unenclosed wire storage tray 372 and/or storage containers 718 are unavailing as they fail to meet the proper definition of compartments – *e.g.*, the definition agreed to by the Patent Owner and Petitioner in the on-going Litigation and the W.D.N.C. claim construction order – which requires the compartments to be enclosed. '668 IPR Petition at pg. 47; '650 IPR Petition at pg. 58 (citing figure 31 of Reeder). Additionally, as explained in detail below, these wire trays and storage bins are not “disposed in” anything, much less a height adjustable work platform as recited in the claims at-issue.

50. The remaining embodiments of Reeder teaching drawers 346, 394 do not teach that the drawers are height adjustable. *See* Reeder, Figs. 30, 32, 33. The only brief mention in Reeder of using drawers 346, 394 is with regard to the embodiment shown in figures 30 and 32-33, none of which are height adjustable. *Id.*, *e.g.*, para. [0117]-[0119].<sup>8</sup> Presumably, this is because the top-heavy embodiment of Reeder figures 31, 45-46 lack the requisite central base portion 344, 392 in which to dispose such drawers 346, 394. *Id.* Instead, Reeder uses fixed, forward legs 396 and/or base 342 to provide needed

---

<sup>8</sup> Reeder fails to make any reference to use of drawers 346, 394 with respect to the top-heavy embodiments of figures 31 or 45-46. *See id.* Notably, while beginning with a discussion of figures 30-33, Reeder expressly move away from figure 31 in its discussion regarding the drawers 344, 392. *See id.*

stability in this regard. Reeder, *e.g.*, figures 30, 32, para. [0117], [0119]. Notably, these embodiments instead provide height adjustability to a computer 10 by way of a telescoping arm 408, such as highlighted in the annotated version of figure 33 below. *E.g., Id.* at para. [0119]. Reeder presumably moved to this approach with a stationary set of drawers and height adjustable computer 10 in these embodiments to provide stability/balance.

51. Reeder fails to teach or suggest making the alleged compartments part of a height adjustable work platform as claimed. At a minimum, Petitioner provides only conclusory allegations in this regard, alleging that modification is a matter of simple substitution, and fails to address this balance/stability consideration. '668 IPR Petition at 68-69; '650 IPR Petition at 60. As discussed in more detail below, on the contrary, a PHOSITA would not be motivated to add compartments to the height adjustable workstation/work surface of Reeder as the already top-heavy workstation of Reeder (like Clark) would be easily toppled over from the added weight. If anything, Reeder teaches away from height adjustable compartments, as the only embodiments of Reeder that describe compartments configure the drawers as part of a stationary base that are not height adjustable at all (Reeder figures 30, 32-33). It is improper for Petitioner to use the teachings of the '668 and '650 Patents, in hindsight, as a blueprint for combining or modifying references to meet the

claimed inventions. In view of the foregoing, it is my opinion that Reeder fails to teach or suggest the claimed height adjustable compartment(s).

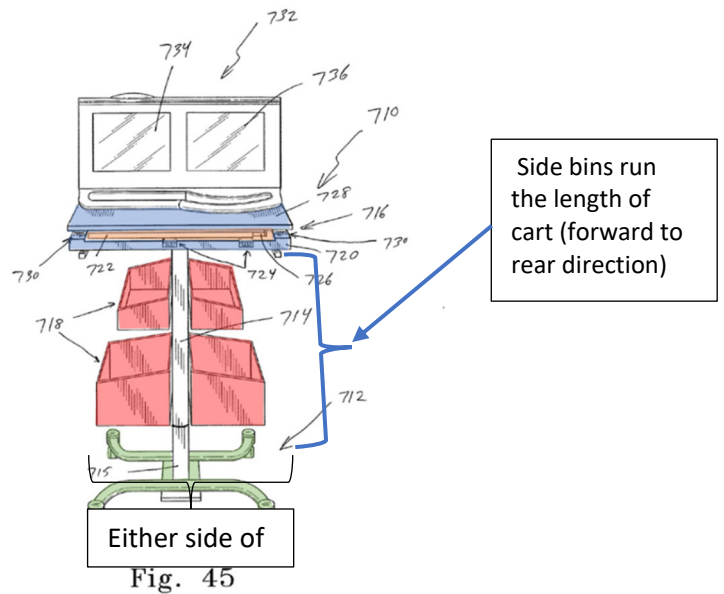
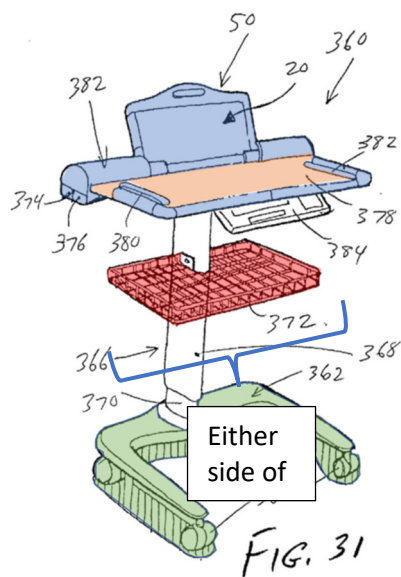
**REEDER FAILS TO TEACH OR SUGGEST COMPARTMENT(S)  
“DISPOSED IN THE PORTION OF THE WORK PLATFORM THAT  
PROJECTS FROM [OR RELATIVE TO] THE HEIGHT ADJUSTMENT  
MECHANISM IN THE FORWARD DIRECTION**

52. Even assuming that Reeder teaches “compartments”, none of the cited wire storage tray 372 and storage containers 718 or drawers 394 are disposed in the alleged height adjustable work platform, much less in a portion of an alleged work platform projecting from the height adjustment mechanism in the forward direction as recited in the claims at issue. Petitioner incorrectly interprets the teachings of Reeder and wrongly assumes that Reeder teaches this limitation (relying on Figures 31, 45). *See* ’668 IPR Petition, pgs. 66-69, Kemnitzer, at 144-147; ’650 IPR Petition, pgs. 75-78.

53. Again, Petitioner takes an unreasonably broad, unsupported and impossible interpretation of the claim terms “the compartments are disposed in the portion of the work platform that projects from [relative to] the height adjustment mechanism in the forward direction.” For example, Petitioner essentially argues that a front area (or front pocket of space) of their alleged compartment meets this limitation. *See Id.* (arguing that the front space of the wire trays and side bins of Reeder meets this limitation). In an attempt to stretch Reeder’s teaching to meet the claims, Petitioner’s argument essentially

divides the alleged compartments into separate, fractional pockets of space/air. Again, such an interpretation is unsupported and contrary to a reasonable reading of the '668 and '650 Patents as previously discussed above with respect to the Clark reference.

54. Inspection of the side view of the cart of Reeder illustrates that these wire trays and side bins of Reeder merely hang off the center support and are not “disposed in” anything, much less in the portion of the alleged work platform that projects from [or relative to] a height adjustment mechanism in the forward direction as specifically claimed in the claims at-issue. Reeder at figures 31, 45-46. For example, similar to Clark, the wire tray and side bins of Reeder hang off the sides and to the rear of the central support 714, and therefore are disposed outside of a portion of the work platform that projects from [or relative to] the height adjustment mechanism in the forward direction. The annotated versions of figures 31 and 45 from the Petition are reproduced below with further annotations to demonstrate this distinction. '668 IPR Petition at pgs. 57-58.



55. This distinction is better illustrated in the perspective view of Figure 46 of

Reeder. As illustrated in the annotated Figure 46 of Reeder shown here, even if the wire tray and side bins of Reeder are considered compartments (which they are not as they are

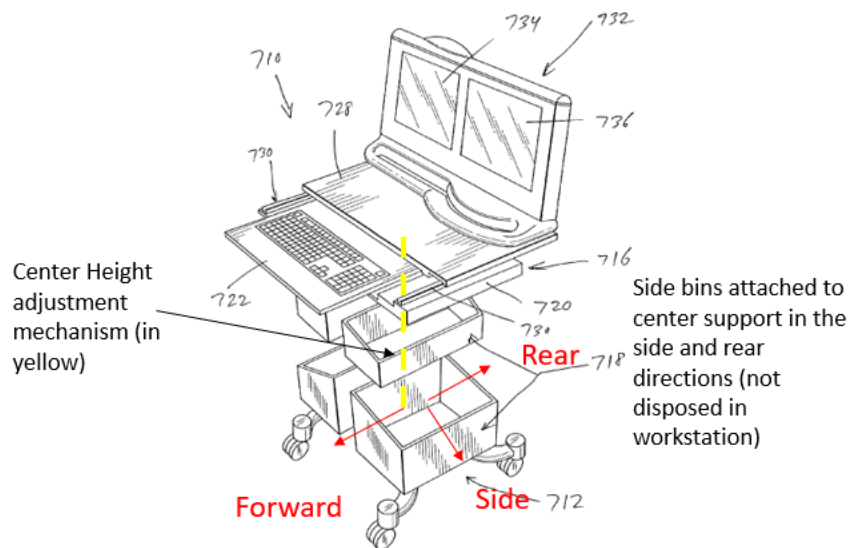


Fig. 46

not enclosed in anything), they hang off the side of the height adjustment mechanism (center vertical support 714) and run the entire length (forward to rear) of the cart and thus are not “disposed in the portion of the work platform

that projects from [or relative to] the height adjustment mechanism in the forward direction” (i.e., these alleged compartments of Reeder are clearly disposed outside the forward-projecting region). Only a front pocket of space/air of the alleged compartments of Reeder is found in the forward-projecting space, but the alleged compartment itself is not. Thus, Reeder fails to teach or suggest all of the claimed embodiments, alone or in combination.

56. The Petition should also be denied because Petitioner fails to articulate any basis for why a PHOSITA would be motivated to modify the cart of Reeder to include a compartment “disposed in the portion of the work platform that projects from [or relative to] the height adjustment mechanism in the *forward direction*” as claimed. Petitioner instead mistakenly assumes that side bins and wire trays or substituted drawers<sup>9</sup> of Reeder meet this limitation and thus Petitioner completely fails to articulate a motivation to combine or modify Reeder to reach this limitation or evidence that there would be a reasonable expectation of success in doing so.<sup>10</sup> See ’668 IPR Petition at 66-69,

---

<sup>9</sup> Petitioner states in conclusory fashion that a PHOSITA would know to substitute drawers for the side bins or trays shown in Reeder, yet this substitution, if even possible, would also not reach the invention as any substituted drawers, like the side bins and trays, would also be disposed outside the forward-projecting portion. ’668 IPR Petition, pg. 68; ’650 IPR Petition, pg. 60.

<sup>10</sup> In other words, Petitioner alleges in conclusory fashion that a PHOSITA would know to add drawers to the “bottom side of the work platform” but never opines on if a PHOSITA would be motivated to dispose drawers in a *forward-projecting* portion of a height adjustable work platform, how it would be accomplished, or that there would be a reasonable expectation of success in view of Reeder’s centrally located support column and top-heavy design. Petitioner cites to the Ellman reference for support, but Ellman does not teach height adjustable compartments at all much less

Kemnitzer, 144-147; '650 IPR Petition, 75-78. This failure alone amounts to a basis for denying the Petition as Petitioner has failed to demonstrate all the required proof for meeting a *prima facie* case of obviousness.

57. There is no motivation or reasonable expectation of success of modifying Reeder to include compartments in a forward-projecting portion of a height adjustable work platform because 1. the alleged work platform of Reeder is mounted on entirely on top of a centrally located support, thus there is insufficient space to dispose compartments in a portion of the workstation that projects from [or relative to] the center support in the forward direction; and 2. as similarly argued during the prosecution of the related '650 Patent in overcoming Clark, a PHOSITA would not be motivated to dispose additional, heavy components, such as compartments, in the already top-heavy workstations of Reeder as doing so would destabilize Reeder, rendering the workstations more readily prone to toppling over. Mirroring the arguments made in the prosecution of the related '650 Patent in overcoming Clark: if a PHOSITA had tried to incorporate the heavy compartments into the workstation of Reeder in the manner claimed, the resulting workstation would be top heavy, particularly when the compartments were deployed. The result

---

disposed in a portion of the work platform projecting from a height adjustment mechanism in the forward direction. '668 IPR Petition, at pg. 68.

is that the compartments would make the workstation of Reeder unstable so that it would be easily knocked over. Notably, in this regard Reeder teaches the cited embodiment of figure 31 as having a “*central* pedestal 366” and the cited embodiment of figure 45 as likewise having a “*center* vertical support 714,715.” Reeder, paras. [0118], [0148], respectively (emphasis added). On the contrary, the claimed compartments work in the cart of the ’668 invention because the claimed cart has a different, lower center of gravity, a condition lacking in Reeder. In other words, the overall design of the inventive cart of the ’668 Patent (including its lower, different center of gravity) permits the use of height adjustable compartments while the workstation of Reeder (with its different, higher center of gravity) does not. Accordingly, a PHOSITA would not modify or combine the teachings of Reeder so as to arrive at a height-adjustable work platform with compartment(s) disposed in a portion of the work platform projecting from [or relative to] the height adjustment mechanism in the forward direction”. The inventor of the ’668 Patent was the first to think of placing the height adjustment mechanism at the rear of the height adjustable work platform allowing ample space to dispose the compartments in a forward-projecting portion of a height adjustable work platform resulting in cart with a lower center of gravity.

## ARGUMENTS AROUND PETITIONER'S EXPERT TESTIMONY

58. Petitioner's Expert, Mr. Kemnitzer, has qualification that fail to meet Patent Owner's proffered definition of a PHOSITA. Notably, Mr. Kemnitzer's education and experience is in industrial design, rather than mechanical engineering. *E.g.*, Ex. 1004 at ¶ 4-6. Such qualifications are directed more toward aesthetics than hard science. Mechanical engineering concerns are at the core of certain deficiencies in Mr. Kemnitzer's analysis, as further described herein.

59. Mr. Kemnitzer testifies that "[t]hough not shown in the figures, Clark explains that the cavity may be a drawer". Ex. 1004 at ¶ 59 (citing figures 4A-4B and col. 10 ll. 30-33). This is incorrect. This passage, at best, teaches placing a separate drawer or pull-out tray above or below the tray 12. This passage does not state that such a drawer or pull-out tray is attached to the tray 12 or moveable therewith.

60. Mr. Kemnitzer notes that "Clark's gas spring driver is controlled by a release lever 42 that extends through<sup>11</sup> 'an opening in the side of a horizontal tray.'"

---

<sup>11</sup> Notably, the cited passage of Clark provides no such teaching. Presuming Petitioner's Expert intended to cite the corresponding lines from column 9 in Clark, this passage makes it clear that the release lever 42 is located *within* the tray 12 rather than "extending *through* 'an opening in the side of a horizontal tray'" as alleged by Mr. Kemnitzer. Clark, 9:51-62 (emphasis added). Indeed, Clark teaches that "[t]o raise the tray, the operator places *his or her hand through* an opening 40 in the side of the horizontal tray 12... [to] lifts[] a release lever 42...." Col. 9 ll. 56-60 (emphasis added). This is consistent with the top, perspective view in figure 5B where the release lever 42 clearly resides within the tray 12.

Clark, 10:51-62.”. Ex. 1004 at ¶ 47. Based on the aforementioned passage regarding a separate drawer or pull-out tray above or below the tray 12 of Clark, Mr. Kemnitzer concludes that, “a POSITA implementing the drawer embodiment recited in Clark would have recognized the interior drawer contents would compromise the functionality of the lever 42, for example, by preventing actuation or unintentionally activating lever 42.” *Id.* However, Clark presumably teaches this above/below relationship because locating such a drawer within the tray 12 would interfere with the release lever 42. If the drawer of Clark is placed above or below the tray 12, there would be no interference with the release lever 42 since Clark teaches that the release lever 42 is disposed *within* the tray 12. Thus, Mr. Kemnitzer’s concern about interference with the release lever 42 actually teaches away from placement of the drawer or other such compartment(s) within the tray 12 of Clark as alleged by Petitioner.

61. In this regard, Mr. Kemnitzer’s cited concern of “a hole in the side of the horizontal tray would compromise the functionality of the drawer because the interior drawer contents would be accessible from the side through the hole” is likewise without merit as Clark teaches placing the alleged drawer above or below the tray 12, rather than within it. Ex. 1004 at ¶ 47.

62. Furthermore, Mr. Kemnitzer’s analysis appears to be predicated on the notion

that Clark teaches or suggests modifying the tray 12 to include anything other than a keyboard tray. *See* Ex. 1004 at ¶ 47. For example, Mr. Kemnitzer’s analysis discusses the “security of health information (medical histories, test results, prescriptions, etc.,) as well as the medications themselves” as presumably being placed in these areas. *Id.* However, Clark expressly teaches that the tray 12 is used to support a pull-out keyboard tray 70 stowable therein. *E.g.*, col. 11 ll. 40-50. And the cited drawer embodiment of Clark is expressly used for the docking station 18, which is used to store a wireless computer terminal 20 with a display screen. *E.g.*, col. 8 ll. 58-61, col. 10 ll. 30-33. Thus, Clark fails to teach or suggest storing other components in these areas. This deficiency is not addressed in Mr. Kemnitzer’s testimony or otherwise by Petitioner. This is demonstrative of the hindsight nature of the analysis in Mr. Kemnitzer’s testimony and used by Petitioner more generally to arrive at its conclusions. In view of the foregoing, Mr. Kemnitzer’s testimony, and Petitioner’s analysis adopting the same, is deficient at least for using hindsight bias and providing meritless alleged motivations to modify Clark.

63. Additionally, recognizing the deficiency in Clark with regard to multiple *arguendo* compartments, Mr. Kemnitzer declares that it would have been obvious to “...subdivide the cavity in Clark with multiple drawers....” Ex. 1004 at ¶ 60. This is notable as Petitioner’s expert admits that this area as a

“cavity” rather than a functional “compartment”. *See id.* Also, because Mr. Kemnitzer’s analysis fails to consider the stated purpose of the cavity in Clark as a pull-out keyboard tray. *E.g.*, col. 11 ll. 40-50. Mr. Kemnitzer’s analysis fails to explain how this cavity of Clark could still be used for its intended purpose as a keyboard tray if it were subdivided. Indeed, if the cavity of Clark were so subdivided it could no longer accommodate a keyboard tray, which would extend all or substantially all the lateral width thereof. For at least this additional reason, Mr. Kemnitzer’s testimony, and Petitioner’s analysis adopting the same, is deficient and should be afforded little to no weight.

Further still, Mr. Kemnitzer’s analysis fails to consider the resulting top-heavy nature of a modified Clark as proposed. As discussed herein, the proposed modifications to Clark are not a matter of simple substitution, particularly considering such a substitution would result in a further destabilized and top-heavy cart prone to tipping.

64. Mr. Kemnitzer’s background in industrial design rather than mechanical engineering becomes apparent particularly with regard to the analysis of Reeder. For example, Mr. Kemnitzer concludes that one could simply substitute the storage tray 372 and/or storage containers 718 of Reeder with the drawers, Mr. Kemnitzer’s analysis fails to account for the fact that the storage tray 372 and/or storage containers 718 of Reeder are not located within the

alleged work platform as claimed and that such a modification would render the cart further destabilized, top-heavy cart, and prone to tipping for at least the reasons explained in this response. Ex. 1004 at ¶ 76.

I declare under penalty of perjury that the foregoing is true and accurate.

Executed this 28 day of November, 2023.



---

Pinhas Ben-Tzvi

## **EXHIBIT 1**

**Pinhas Ben-Tzvi, Ph.D., P.E., FASME, SMIEEE**  
College of Engineering Faculty Fellow  
Professor of Mechanical Engineering  
Professor of Electrical and Computer Engineering  
Director, VT Robotics and Mechatronics Laboratory (RMLab)  
*Department of Mechanical Engineering, Virginia Tech*  
*Tel: (202) 641-8011*  
*Email: [pinhas.bentzvi@gmail.com](mailto:pinhas.bentzvi@gmail.com); Website: [www.RMLab.org](http://www.RMLab.org)*

---

## Professional Experience

---

- 08/2022–Present: **Program Director**  
Established Program to Stimulate Competitive Research (EPSCoR)  
Office of the Director (OD), Office of Integrative Activities (OIA)  
National Science Foundation (NSF), Alexandria, VA
- 06/2020–Present: **Professor**  
Department of Mechanical Engineering,  
Virginia Tech, Blacksburg, VA
- 06/2020–Present: **Professor** (by courtesy)  
Bradley Department of Electrical and Computer Engineering,  
Virginia Tech, Blacksburg, VA
- 08/2015–05/2020: **Associate Professor**  
Department of Mechanical Engineering,  
Virginia Tech, Blacksburg, VA
- 05/2016–Present: **Associate Professor** (by courtesy)  
Bradley Department of Electrical and Computer Engineering,  
Virginia Tech, Blacksburg, VA
- 08/2014–08/2015: **Associate Professor**  
Department of Mechanical & Aerospace Engineering,  
George Washington University, Washington, DC
- 09/2008–08/2014: **Assistant Professor**, Department of Mechanical & Aerospace Engineering,  
George Washington University, Washington, DC
- 09/2008–Present: **Founder and Director**, Robotics and Mechatronics Laboratory,  
Virginia Tech, Blacksburg, VA: Aug 2015 - Present  
George Washington University, Washington, DC: Sep 2008 – Aug 2015
- 2006 – 2008: **Lecturer**, Department of Mechanical & Industrial Engineering,  
University of Toronto, Ontario, Canada
- 2006 – 2008: **Consultant**, Mobile Robots Division, Engineering Services Inc., Toronto, Canada  
Design, Development and Integration of Mobile Robot Systems/Mechanisms
- 2002 – 2008: **Graduate Research Assistant**, Department of Mechanical Engineering,  
University of Toronto, Ontario, Canada  
Mobile robot mechanisms with hybrid mobility and manipulation (Ph.D.);  
Dispensing systems for microdrops generation in medical applications (M.S.)

- 2002 – 2008: **Graduate Teaching Assistant**, Department of Mechanical Engineering, University of Toronto, Ontario, Canada
- 2000 – 2002: **R&D Mechanical Engineer**, General Electric Medical Systems, Haifa, Israel  
Conducted research on design, development, and integration of mechanisms and mechatronic/robotic systems for medical imaging systems (CT, PET, MRI)
- 1998 – 2000: **Research Assistant**, Technion – Israel Institute of Technology, Haifa, Israel  
Developed sensors and control system for a deep drawing mechanical process
- 1993 – 1996: **First Sergeant**, Israeli Air Force Academy

### **Professional Credential**

2020–present **Licensed Professional Engineer (P.E.)**, Maryland

### **Other Professional Affiliations/Experience:**

- 08/2015–Present: **Core Faculty Member**  
Virginia Center for Autonomous Systems (VaCAS)  
Virginia Tech, Blacksburg, VA
- 08/2015–Present: **Affiliate Faculty Member**  
Center for Bioinspired Science and Technology (BIST)  
Virginia Tech, Blacksburg, VA

---

## **Education**

- |                                                                                                                                                 |      |
|-------------------------------------------------------------------------------------------------------------------------------------------------|------|
| <b>Ph.D., University of Toronto</b><br>Department of Mechanical Engineering (GPA 4.0/4.0)                                                       | 2008 |
| <b>M.Sc., University of Toronto</b><br>Department of Mechanical Engineering (GPA 4.0/4.0)                                                       | 2004 |
| <b>B.Sc. (<i>Summa Cum Laude</i>), Technion – Israel Institute of Technology</b><br>Department of Mechanical Engineering (GPA 4.0/4.0)          | 2000 |
| <b>Practical Engineer Diploma</b> , ORT Vocational College, Haifa, Israel<br>Mechanical Engineering ( <i>with Highest Honors</i> , GPA 4.0/4.0) | 1993 |

---

## **Research Expertise and Interests**

My research and industrial experiences and expertise span the areas of mechanical/mechatronics design, electromechanical systems design, smart precision sensors and actuators, precision engineering design, mechanism/product design and system integration, intelligent autonomous systems and robotics, precision healthcare technologies, cyber-physical systems, machine learning and AI, human-machine interactions, industrial automation systems, feedback motion control systems, system dynamics.

### **Examples of research expertise include:**

- Electromechanical Systems Design, Integration and Prototyping
- Linear Motion Control, Drivers, Actuators and Sensors
- Ergonomic Industrial Design
- Mechatronic and Robotic Systems - Design, Modeling, Simulation, Analysis, Integration

- Precision Mechanism and Machine Design, Analysis and Synthesis
- Sensing, Precision Actuation Devices and Measurement Modalities for Applications (vehicles, biomedical, industrial, etc.)
- Microprocessor-based Distributed and Modular Control Systems
- System Dynamics and Control
- Computer Aided Design/Engineering CAD/CAE
- Industrial Automation and Manufacturing Systems
- Intelligent Autonomous Systems
- Modular and Reconfigureable Robotic and Mechanical Systems
- Dexterous Robotic Manipulation - Tele-Operation, Autonomous Navigation/Function
- Rehabilitation and Medical Robotics
- Robotic Vision/Perception and Visual Servoing
- Bioinspired & Biomimetic Robotic Locomotion and Manipulation
- Continuum/Flexible Mechanisms and Structures
- Haptics Interfaces and Devices for Robotics Applications

---

## Awards and Honors

---

### Certificate of Recognition, Celebration Innovation

April 2023

Virginia Tech Senior Vice President for Research & Innovation

"In recognition of being awarded and issued patents in FY 2022, and important Step in ensuring important discoveries reach the people who will benefit most".

### Faculty Inventor Spotlight

May 2022

Virginia Tech Center for Technology Commercialization

<https://vt.edu/link/license/faculty-inventors/pinhas-ben-tzvi.html>

### Fellow, American Society of Mechanical Engineers (ASME)

January 2022

Fellowship is bestowed upon members who have made significant contributions to mechanical engineering with less than 3400 of ASME's approximate 140,000 members receiving the honor

### Certificate of Outstanding Professional Service

November 2021

ASME Journal of Mechanisms and Robotics

In recognition of your dedicated service to the *Journal of Mechanisms and Robotics* and the Mechanisms and Robotics community at large (2018-2021)

### Featured Journal Publication

October 2021

Guo, Y., Xu, W., Pradhan, S., Bravo, C.J., **Ben-Tzvi, P.**, "Data Driven Calibration and Control for Compact Lightweight Series Elastic Actuators for Robotic Exoskeleton Gloves", *IEEE Sensors Journal*, Vol. 21, Issue 19, pp. 21120-21130, October 2021. DOI: 10.1109/JSEN.2021.3101143

\* **Selected as a featured article**

### Certificate of Outstanding Professional Service as Technical Editor

January 2021

IEEE/ASME Transactions on Mechatronics

In grateful appreciation for, and recognition of, your dedicated service in advancing the science and art of mechatronics as Technical Editor (2016-2020)

### Certificate of Outstanding Service as Associate Editor

January 2021

International Journal of Control, Automation, and Systems (IJCAS)

In Grateful Recognition of Many Years of Dedicated Service to the Control Community as an Associate Editor of IJCAS (January 1, 2011 – December 31, 2020)

### Certificate of Appreciation in Outstanding Professional Service

August 2019

The Design Engineering Division, ASME  
In Recognition of Outstanding Service as Program Co-Chair of the 43<sup>rd</sup> Mechanisms and Robotics  
Conference (MR) 2019

**Excellence in Teaching Award**

May 2019

College of Engineering, Virginia Tech  
In Recognition of Extraordinary Performance in Teaching

**IJCAS Academic Activity Award**

January 2019

International Journal of Control, Automation, and Systems (IJCAS)  
"In recognition of his outstanding service and dedicated work as an editorial board member of the  
IJCAS and for his exceptional contributions in the advancement of the journal."

**Faculty Fellow, College of Engineering**

April 2018

Virginia Tech  
In Recognition of Extraordinary Performance in Research

**Keynote Speech Award**

February 2018

International Conference on Mechatronics Systems and Control Engineering  
"In honor of your excellent Keynote Speech and your significant contribution to the  
success of 2018 International Conference on Mechatronics Systems and Control  
Engineering (ICMSCE 2018), Amsterdam, Netherlands, Feb 21-23, 2018"

**Virginia Tech Inventor of the Month**

August 2016

The Office of the Vice President for Research and Innovation recognizes  
Pinhas Ben-Tzvi as Inventor of the Month for August 2016 for his multiple  
inventions disclosed to Virginia Tech Intellectual Properties Inc.

**IJCAS Academic Activity Award**

December 2013

International Journal of Control, Automation, and Systems (IJCAS)  
"In recognition of his outstanding service and dedicated work as an editorial board member of the  
IJCAS and for his exceptional contributions in the development of the journal."

**GW SEAS Outstanding Young Researcher Award**

April 2013

<http://www.rmlab.org/honors.php>

"In recognition of his demonstrated and exceptional contributions to robotics, mechatronics,  
mechanism design and integration, systems dynamics and control, and sensing and actuation.  
Developing a very strong and externally sponsored program that covers both theoretical and applied  
research, Prof. Ben-Tzvi has quickly established himself as one of the leading researchers in the  
field of robotics, mechatronics, and controls. He founded the GW Robotics & Mechatronics Research  
Laboratory, and used both the lab and his research to help launch the GW robotics program."

**GW SEAS Outstanding Young Teacher Award**

April 2013

<http://www.rmlab.org/honors.php>

"In recognition of his dedicated pursuit of innovative curricula and teaching methods, his efforts to  
develop the robotics program at SEAS, and his STEM-related mentoring and outreach activities to  
the local community. Prof. Ben-Tzvi works tirelessly to improve and promote robotics education, in  
particular, and STEM-related education in general. He has developed new courses and new labs for  
students, initiated and spearheaded the development of a new robotics degree program option for  
undergraduate students, and created a variety of STEM-related educational outreach activities in  
robotics for the community beyond SEAS."

**IEEE Senior Member** (highest grade below fellow)

April 2012

**Winner of the Best Paper Award**

October 2011

for the paper entitled "MEMS-Based Microdroplet Generation with Integrated Sensing"

presented at the 2011 COMSOL Conference, Boston, MA, Oct 13–15, 2011  
(with Doctoral Student William Rone)

**Pi Tau Sigma**

November 2009

Faculty Honorary Membership (elected by the students)

**Featured Journal Publication**

March 2009

Cover Article: "Design and Analysis of a Fast Steering Mirror for Precision Laser Beams Steering"; *Sensors & Transducers Journal*, 5(3): 104–118 (2009)

**The Robotdalen Scientific Award**

September 2008

Honorable Mention Recipient, Eskilstuna, Sweden

**Governor General's Gold Medal Award of Canada - Finalist**

May 2008

Nominated by the Dept. of Mechanical Engineering at the University of Toronto among 60 graduated Ph.D. students to honor academic excellence at the doctoral level

**Winner of the Best Student Paper Award**

October 2007

for the paper entitled "Implementation of Sensors and Control Paradigm for a Hybrid Mobile Robot Manipulator for Search and Rescue Operations" presented at the *2007 IEEE International Workshop on Robotic & Sensors Environments (ROSE 2007)*

**University of Toronto Open Fellowship** (four awards)

2004 – 2008

Doctorate Research, University of Toronto

**University of Toronto Open Fellowship** (two awards)

2002 – 2003

Masters Research, University of Toronto

**Summa Cum Laude**, B.Sc. in Mechanical Engineering

September 2000

Technion – Israel Institute of Technology (IIT)

**President's Honors List Award** (five awards)

1998 – 2000

Undergraduate Studies, Faculty of Mechanical Engineering, Technion – IIT

**Dean's Honors List Award** (two awards)

1996 – 1998

Undergraduate Studies, Faculty of Mechanical Engineering, Technion – IIT

**Award for Outstanding Academic Achievements**

1998

Undergraduate Studies at the Technion – Israel Inst. of Tech., Ministry of Education, Israel

---

## **Publications**

---

### **Books**

- [1] Kurdila, A.J., **Ben-Tzvi, P.**, Dynamics and Control of Robotic Systems. Wiley & Sons, Inc., December 2019, ISBN: 978-1-119-52483-0. (520 pages)

### **Peer-Reviewed Journal Publications** (75 published, 1 accepted, 3 submitted/under review)

- [79] Liu, Y., **Ben-Tzvi, P.**, "VT Lemur: A Novel Quadruped Robot with a Serpentine Robotic Tail," *International Journal of Robotics Research*, **Under review**, January 2023.
- [78] Guo, Y., Xu, W., **Ben-Tzvi, P.**, "Vision Based Human Machine Interface for a Rehabilitation Robotic Exoskeleton Glove", *IEEE Transactions on Systems, Man, and Cybernetics:*

Systems, **Under review**, December 2022.

- [77] Liu, Y., **Ben-Tzvi, P.**, “How a Serpentine Tail Assists Agile Motions of Kangaroo Rats: A Dynamics and Control Approach”, Nonlinear Dynamics, **Accepted with minor revisions**, February 2023. <https://doi.org/10.21203/rs.3.rs-1315822/v1>
- [76] Xu, W., Guo, Y., Bravo, C.J., **Ben-Tzvi, P.**, “Design, Control, and Experimental Evaluation of a Novel Robotic Glove System for Patients with Brachial Plexus Injuries”, IEEE Transactions on Robotics, Vol. 39, Issue 2, pp. 1637-1652, April 2023. DOI: 10.1109/TRO.2022.3220973
- [75] Feng, S., Pressgrove, I., **Ben-Tzvi, P.**, “A Modular Robotic System with Self-Reconfiguration Strategies Demonstrating Autonomous Module-to-Module Alignment and Docking”, Journal of Mechanisms and Robotics, Transactions of the ASME, **Under review**, April 2022.
- [74] Han, X., Ren, H., Qi, J., **Ben-Tzvi, P.**, “Autonomous Cricothyroid Membrane Detection and Manipulation using Neural Networks and Robot Arm for First-Aid Airway Management”, Journal of Medical Devices, Transactions of the ASME, Vol. 17, Issue 1, pp. 014502: 1-9, March 2023. DOI: <https://doi.org/10.1115/1.4056505>
- [73] Guo, Y., Xu, W., Pradhan, S., Bravo, C.J., **Ben-Tzvi, P.**, “Personalized Voice Activated Grasping System for a Robotic Exoskeleton Glove”, Mechatronics Journal, Vol. 83, pp. 102745:1-12, May 2022. DOI: 10.1016/j.mechatronics.2022.102745
- [72] Sohal, S.S., Sebastian, B., **Ben-Tzvi, P.**, “Autonomous Docking of Hybrid-Wheeled Modular Robots With an Integrated Active Genderless Docking Mechanism”, Journal of Mechanisms and Robotics, Transactions of the ASME, Vol. 14, Issue 1, pp. 011010: 1-15, February 2022. DOI: [doi.org/10.1115/1.4051519](https://doi.org/10.1115/1.4051519)
- [71] Njaka, T., Brizzolara, S., **Ben-Tzvi, P.**, “Design and Experimental Validation of a Novel High-Speed Omnidirectional Underwater Propulsion Mechanism”, IEEE/ASME Transactions on Mechatronics, Vol. 26, Issue 5, pp. 2339-2349, October 2021. DOI: 10.1109/TMECH.2020.3037887
- [70] Guo, Y., Xu, W., Pradhan, S., Bravo, C.J., **Ben-Tzvi, P.**, “Data Driven Calibration and Control for Compact Lightweight Series Elastic Actuators for Robotic Exoskeleton Gloves”, IEEE Sensors Journal, Vol. 21, Issue 19, pp. 21120-21130, October 2021. DOI:10.1109/JSEN.2021.3101143 \* **Selected as a featured article**
- [69] Yang, J., Saab, W., Liu, Y., **Ben-Tzvi, P.**, “Reuleaux Triangle Based Two Degrees of Freedom Bipedal Robot”, Robotics Journal, Vol. 10, Issue 4, pp. 1-15, October 2021. DOI: 10.3390/robotics10040114
- [68] Liu, Y., **Ben-Tzvi, P.**, “Dynamic Modeling, Analysis, and Design Synthesis of a Reduced Complexity Quadruped with a Serpentine Robotic Tail”, Integrative and Comparative Biology, Vol. 61, Issue 2, pp. 464-477, August 2021. DOI: 10.1093/icb/icab083
- [67] Liu, Y., **Ben-Tzvi, P.**, “A New Extensible Continuum Manipulator Using Flexible Parallel Mechanism and Rigid Motion Transmission”, Journal of Mechanisms and Robotics, Transactions of the ASME, Vol. 13, Issue 3, pp. 031112: 1-7, June 2021. DOI: [doi.org/10.1115/1.4050097](https://doi.org/10.1115/1.4050097)
- [66] Feng, S., Sebastian, B., **Ben-Tzvi, P.**, “A Collision Avoidance Method Based on Deep Reinforcement Learning”, Robotics Journal, Vol. 10, Issue 2, pp. 1-19, May 2021.

- [65] Ren, H., Qi, J., **Ben-Tzvi, P.**, “Learning Flatness-Based Controller Using Neural Networks”, ASME Letters in Dynamic Systems and Control, Vol. 1, Issue 2, pp. 021003: 1-6, April 2021. DOI: 10.1115/1.4046776
- [64] Wang, J., Liu, Y., **Ben-Tzvi, P.**, “Robust Adaptive Input-Output Control for a Class of Modular Robotic Systems via Inverse Optimality Theory”, International Journal of Control, Vol. 95, Issue 7, pp. 1898-1912, July 2022. DOI:10.1080/00207179.2021.1885741
- [63] Liu, Y., **Ben-Tzvi, P.**, “Dynamic Modeling, Analysis, and Comparative Study of A Quadruped With Bio-Inspired Robotic Tails”, Multibody System Dynamics, Vol. 51, Issue 2, pp. 195-219, February 2021. DOI: 10.1007/s11044-020-09764-8
- [62] Vanteddu, T., **Ben-Tzvi, P.**, “Stable Grasp Control with a Robotic Exoskeleton Glove”, Journal of Mechanisms and Robotics, Transactions of the ASME, Vol. 12, Issue 6, pp. 061015: 1-14, December 2020.
- [61] Wang, X., Ren, H., Kumar, A., **Ben-Tzvi, P.**, “Design and Analysis of a Variable Inertia Spatial Robotic Tail for Dynamic Stabilization”, Biomimetics, Vol. 5, Issue 4, pp. 1-16, November 2020. DOI: 10.3390/biomimetics5040055
- [60] Liu, Y., **Ben-Tzvi, P.**, “An Articulated Closed Kinematic Chain Planar Robotic Leg for High Speed Locomotion”, Journal of Mechanisms and Robotics, Transactions of the ASME, Vol. 12, Issue 4, pp. 041003: 1-15, August 2020. DOI: 10.1115/1.4045689
- [59] Liu, Y., **Ben-Tzvi, P.**, “Design, Analysis and Integration of a New Two-DOF Articulated Multi-link Robotic Tail Mechanism”, Journal of Mechanisms and Robotics, Transactions of the ASME, Vol. 12, Issue 2, pp. 021101: 1-9, April 2020. DOI: 10.1115/1.4045842
- [58] Ren, H., **Ben-Tzvi, P.**, “Advising Reinforcement Learning Towards Scaling Agents in Continuous Control Environments with Sparse Rewards”, Journal to Engineering Applications of Artificial Intelligence, Vol. 90, pp. 103515: 1-12, April 2020. DOI: 10.1016/j.engappai.2020.103515
- [57] Ren, H., **Ben-Tzvi, P.**, “Learning Inverse Kinematics and Dynamics of a Robotic Manipulator using Generative Adversarial Networks”, Robotics and Autonomous Systems, Vol. 124, pp. 103386: 1-12, February 2020. DOI: 10.1016/j.robot.2019.103386
- [56] Chauhan, R., Sebastian, B., **Ben-Tzvi, P.**, “Grasp Prediction Towards Naturalistic Exoskeleton Glove Control”, IEEE Transaction on Human-Machine Systems, Vol. 50, Issue 1, pp. 22-31, February 2020. DOI: 10.1109/THMS.2019.2938139
- [55] Refour, E., Sebastian, B., Chauhan, R., **Ben-Tzvi, P.**, “A General Purpose Robotic Hand Exoskeleton with Series Elastic Actuators”, Journal of Mechanisms and Robotics, Transactions of the ASME, Vol. 11, Issue 6, pp. 060902: 1-9, December 2019.
- [54] Williams, A., Sebastian, B., **Ben-Tzvi, P.**, “Review and Analysis of Search, Extraction, Evacuation, and Medical Treatment Field Robots”, Journal of Intelligent and Robotic Systems, Vol. 96, Issue 3, pp. 401-418, December 2019.
- [53] Budolak, D., **Ben-Tzvi, P.**, “Series Elastic Actuation for Improved Transparency in Time Delayed Haptic Teleoperation”, Mechatronics Journal, Vol. 63, pp. 102278:1-8, November 2019. DOI: 10.1016/j.mechatronics.2019.102278
- [52] Sebastian, B., **Ben-Tzvi, P.**, “Support Vector Machine Based Real-time Terrain Estimation

- for Tracked Robots”, *Mechatronics Journal*, Vol. 62, pp. 102260: 1-10, October 2019.
- [51] Liu, Y., Wang, J., **Ben-Tzvi, P.**, “A Cable Length Invariant Robotic Tail Using a Circular Shape Universal Joint Mechanism”, *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 11, Issue 5, pp. 051005: 1-14, October 2019.
  - [50] Kumar, P., **Ben-Tzvi, P.**, “Estimation of Wind Conditions Utilizing RC Helicopter Dynamics”, *IEEE/ASME Transactions on Mechatronics*, Vol. 24, Issue 5, pp. 2293-2303, October 2019.
  - [49] **Ben-Tzvi, P.**, Saab, W., “A Hybrid Tracked-Wheeled Multi-Directional Mobile Robot”, *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 11, Issue 4, pp. 041008: 1-10, August 2019.
  - [48] Rone, W., Saab, W., Kumar, A., **Ben-Tzvi, P.**, “Controller Design, Analysis and Experimental Validation of a Robotic Serpentine Tail to Maneuver and Stabilize a Quadrupedal Robot”, *Journal of Dynamic Systems, Measurement and Control, Transactions of the ASME*, Vol. 141, Issue 8, pp. 081002: 1-9, August 2019.
  - [47] Sebastian, B., **Ben-Tzvi, P.**, “Physics Based Path Planning for Autonomous Tracked Vehicle in Challenging Terrain”, *Journal of Intelligent and Robotic Systems*, Vol. 95, Issue 2, pp. 511-526, August 2019.
  - [46] Racioppo, P., **Ben-Tzvi, P.**, “Design and Control of an Articulated Cable-Driven Modular Snake Robot”, *IEEE/ASME Transactions on Mechatronics*, Vol. 24, Issue 3, pp. 893-901, June 2019.
  - [45] Ren, H., Kumar, A., **Ben-Tzvi, P.**, “LOSA-X: Expandable 3D Motion Tracking System”, *IEEE Sensors Journal*, Vol. 19, Issue 9, pp. 3288-3295, May 2019.
  - [44] Saab, W., Rone, W., Kumar, A., **Ben-Tzvi, P.**, “Design and Integration of a Novel Spatial Articulated Robotic Tail”, *IEEE/ASME Transactions on Mechatronics*, Vol. 24, Issue 2, pp. 434-446, April 2019.
  - [43] Sebastian, B., **Ben-Tzvi, P.**, “Active Disturbance Rejection Control for Handling Slip in Tracked Vehicle Locomotion”, *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 11, Issue 2, pp. 021003: 1-12, April 2019.
  - [42] Williams, A., Sebastian, B., **Ben-Tzvi, P.**, “A Robotic Head Stabilization Mechanism for Medical Transport”, *Robotics Journal*, Vol. 8, Issue 1, pp. 1-16, March 2019.
  - [41] Saab, W., Racioppo, P., Kumar, A., **Ben-Tzvi, P.**, “Design of a Miniature Modular Inchworm Robot with an Anisotropic Friction Skin”, *Robotica Journal*, Vol. 37, Issue 3, pp. 521-538, March 2019.
  - [40] Saab, W., Racioppo, P., **Ben-Tzvi, P.**, “A Review of Coupling Mechanism Designs for Modular Reconfigurable Robots”, *Robotica Journal*, Vol. 37, Issue 2, pp. 378-403, February 2019.
  - [39] Rone, W., Liu, Y., **Ben-Tzvi, P.**, “Maneuvering and Stabilization Control of a Bipedal Robot with a Universal-Spatial Robotic Tail”, *Bioinspiration and Biomimetics Journal*, Vol. 14, Issue 1, pp. 016014: 1-16, January 2019.
  - [38] Liu, Y., Kong, M., Wan, N., **Ben-Tzvi, P.**, “A Geometric Approach to Obtain the Closed-Form Forward Kinematics of H4 Parallel Robot”, *Journal of Mechanisms and Robotics*,

Transactions of the ASME, Vol. 10, Issue 5, pp. 051013: 1-9, October 2018.

- [37] Saab, W., Rone, W., **Ben-Tzvi, P.**, "Robotic Tails: A State-of-The-Art Review", Robotica Journal, Vol. 36, Issue 9, pp. 1263-1277, September 2018.
- [36] Lee, J., Williams, A., **Ben-Tzvi, P.**, "Intelligent Object Grasping with Sensor Fusion for Rehabilitation and Assistive Applications", IEEE Transactions on Neural Systems & Rehabilitation Engineering, Vol. 26, Issue 8, pp. 1556-1565, August 2018.
- [35] Rone, W., Saab, W., **Ben-Tzvi, P.**, "Design, Modeling and Integration of a Flexible Universal Spatial Robotic Tail", Journal of Mechanisms and Robotics, Transactions of the ASME, Vol. 10, Issue 4, pp. 041001: 1-14, August 2018.
- [34] Saab, W., Rone, W., **Ben-Tzvi, P.**, "Discrete Modular Serpentine Robotic Tail: Design, Analysis and Experimentation", Robotica Journal, Vol. 36, Issue 7, pp. 994-1018, July 2018.
- [33] Kumar, A., **Ben-Tzvi, P.**, "Novel Wireless Sensing Platform for Experimental Mapping and Validation of Ship Air Wake", Mechatronics Journal, Vol. 52, pp. 58-69, June 2018.
- [32] Refour, E., Sebastian, B., **Ben-Tzvi, P.**, "Two-Digit Robotic Exoskeleton Glove Mechanism: Design and Integration", Journal of Mechanisms and Robotics, Transactions of the ASME, Vol. 10, Issue 2, pp. 025002: 1-9, April 2018.
- [31] Yanga, Y., Ren, H., Yang, X., **Ben-Tzvi, P.**, He, Z., "Optimal Interval of Periodic Polarity Reversal for Maximizing Hydrogen Production in Microbial Electrolysis Cells", International Journal of Hydrogen Energy, Vol. 42, Issue 31, pp. 20260–20268, Aug. 2017.
- [30] Saab, W., Rone, W., **Ben-Tzvi, P.**, "Robotic Modular Leg: Design, Analysis and Experimentation", Journal of Mechanisms and Robotics, Transactions of the ASME, Vol. 9, Issue 2, pp. 024501: 1-6, April 2017.
- [29] Saab, W., **Ben-Tzvi, P.**, "A Genderless Coupling Mechanism with 6-DOF Misalignment Capability for Modular Self-Reconfigurable Robots", Journal of Mechanisms and Robotics, Transactions of the ASME, Vol. 8, Issue 6, pp. 061014: 1-9, December 2016.
- [28] Ma, Z., **Ben-Tzvi, P.**, Danoff, J., "Hand Rehabilitation Learning System with an Exoskeleton Robotic Glove", IEEE Transactions on Neural Systems & Rehabilitation Engineering, Vol. 24, Issue 12, pp.1323–1332, December 2016.
- [27] Zhao, H., **Ben-Tzvi, P.**, "Synchronous Position Control Strategy for Bi-Cylinder Electro-pneumatic Systems", International Journal of Control, Automation and Systems, Vol. 14, Issue 6, pp. 1501-1510, December 2016.
- [26] Kumar, A., **Ben-Tzvi, P.**, "Spatial Object Tracking System Based on Linear Optical Sensor Arrays", IEEE Sensors Journal, Vol. 16, Issue 22, pp. 7933-7940, November 2016.
- [25] **Ben-Tzvi, P.**, Danoff, J., Ma, Z., "The Design Evolution of a Sensing and Force-Feedback Exoskeleton Robotic (SAFER) Glove for Hand Rehabilitation Application", Journal of Mechanisms and Robotics, Transactions of the ASME, Vol. 8, Issue 5, pp. 051019: 1-9, October 2016.
- [24] Rone, W., **Ben-Tzvi, P.**, "Dynamic Modeling and Simulation of a Yaw-Angle Quadruped Maneuvering with a Robotic Tail", Journal of Dynamic Systems, Measurement and Control, Transactions of the ASME, Vol. 138, Issue 8, pp. 084502: 1-7, August 2016.

- [23] Kumar, A., **Ben-Tzvi, P.**, Saab, W., Snyder, M.R., "Wireless Telemetry System for Real-time Estimation of Ship Air Wake with UAVs", *Mechatronics Journal*, Vol. 36, pp. 18-26, June 2016.
- [22] **Ben-Tzvi, P.**, Ma, Z., "Sensing and Force-Feedback Exoskeleton (SAFE) Robotic Glove", *IEEE Transactions on Neural Systems & Rehabilitation Engineering*, Vol. 23, Issue 6, pp. 992-1002, November 2015.
- [21] Ma, Z., **Ben-Tzvi, P.**, "Design and Optimization of a Five-Finger Haptic Glove Mechanism", *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 7, Issue 4, pp. 041008: 1–8, November 2015.
- [20] Ma, Z., **Ben-Tzvi, P.**, "RML Glove – An Exoskeleton Glove Mechanism with Haptics Feedback", *IEEE/ASME Transactions on Mechatronics*, Vol. 20, Issue 2, pp. 641-652, April 2015.
- [19] Rone, W., **Ben-Tzvi, P.**, "Mechanics Modeling of Multi-Segment Rod-Driven Continuum Robots", *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 6, Issue 4, pp. 041006: 1–12, November 2014.
- [18] Moubarak, P., **Ben-Tzvi, P.**, "A Tristate Rigid Reversible and Non-Back-Drivable Active Docking Mechanism for Modular Robotics", *IEEE/ASME Transactions on Mechatronics*, Vol. 19, Issue 3, pp. 840-851, June 2014.
- [17] Rone, W., **Ben-Tzvi, P.**, "Continuum Robot Dynamics Utilizing the Principle of Virtual Power", *IEEE Transactions on Robotics*, Vol. 30, Issue 1, pp. 275–287, February 2014.
- [16] Moubarak, P., **Ben-Tzvi, P.**, "A Globally Converging Algorithm for Adaptive Manipulation and Trajectory Following for Mobile Robots with Serial Redundant Arms", *Robotica Journal*, Vol. 31, Issue 8, pp. 1299-1312, December 2013.
- [15] Rone, W., **Ben-Tzvi, P.**, "Design and FE Analysis of Integrated Sensing using Gas Compressibility for Microdroplet Generation", *Mechatronics Journal*, Vol. 23, Issue 4, pp. 397–408, June 2013.
- [14] Moubarak, P., **Ben-Tzvi, P.**, "On the Dual-Rod Slider Rocker Mechanism and its Applications to Tri-State Rigid Active Docking", *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 5, Issue 1, pp. 011010: 1–10, February 2013.
- [13] Rone, W., **Ben-Tzvi, P.**, "Mapping, Localization and Motion Planning in Mobile Multi-Robotic Systems", *Robotica Journal*, Vol. 31, Issue 1, pp. 1-24, January 2013.
- [12] Moubarak, P., **Ben-Tzvi, P.**, "Modular and Reconfigurable Mobile Robotics", *Journal of Robotics and Autonomous Systems*, Vol. 60, Issue 12, pp. 1648-1663, December 2012.
- [11] Moubarak, P., **Ben-Tzvi, P.**, Zaghoul, M.E., "A Self-Calibrating Mathematical Model for the Direct Piezoelectric Effect of a new MEMS Tilt Sensor", *IEEE Sensors Journal*, Vol. 12, Issue 5, pp. 1033-1042, May 2012.
- [10] **Ben-Tzvi, P.**, Bai, S., Zhou, Q., Huang, X., "Fuzzy Sliding Mode Control of Rigid-Flexible Multi-Body Systems with Bounded Inputs", *Journal of Dynamic Systems, Measurement and Control, Transactions of the ASME*, Vol. 133, Issue 6, pp. 061012: 1–8, November 2011.
- [9] Bai, S., **Ben-Tzvi, P.**, Zhou, Q., Huang, X., "Variable Structure Controller Design for Linear

Systems with Bounded Inputs", *International Journal of Control, Automation and Systems*, Vol. 9, Issue 2, pp. 228–236, April 2011.

- [8] **Ben-Tzvi, P.**, Goldenberg, A.A., Zu, J.W., "Articulated Hybrid Mobile Robot Mechanism with Compounded Mobility and Manipulation and On-Board Wireless Sensor/Actuator Control Interfaces", *Mechatronics Journal*, Vol. 20, Issue 6, pp. 627–639, September 2010.
- [7] **Ben-Tzvi, P.**, "Experimental Validation and Field Performance Metrics of a Hybrid Mobile Robot Mechanism", *Journal of Field Robotics*, Vol. 27, Issue 3, pp. 250–267, May 2010.
- [6] **Ben-Tzvi, P.**, Rone, W., "Microdroplet Generation in Gaseous and Liquid Environments", *Microsystem Technologies Journal*, Vol. 16, Issue 3, pp. 333–356, March 2010.
- [5] **Ben-Tzvi, P.**, Ito, S., Goldenberg, A.A., "A Mobile Robot with Autonomous Climbing and Descending of Stairs", *Robotica Journal*, Vol. 27, Issue 02, pp. 171–188, Feb. 2009.
- [4] Zhou, Q., **Ben-Tzvi, P.**, Fan, D., "Design and Analysis of a Fast Steering Mirror for Precision Laser Beams Steering", *Sensors & Transducers Journal*, Vol. 5, Issue 3, pp. 104-118, March 2009. \*\*\* Listed in the Top 25 List of Most Downloaded Articles in June 2011\*\*
- [3] Bai, S., **Ben-Tzvi, P.**, Zhou, Q., Huang, X., "A Study on Dynamic Stiffening of a Rotating Beam with a Tip Mass", *Sensors & Transducers Journal*, Vol. 5, Issue 3, pp. 53-68, 2009.
- [2] **Ben-Tzvi, P.**, Goldenberg, A.A., Zu, J.W., "Design and Analysis of a Hybrid Mobile Robot Mechanism with Compounded Locomotion and Manipulation Capability", *Journal of Mechanical Design, Transactions of the ASME*, Vol. 130, Issue 7, pp. 1–13, July 2008.
- [1] **Ben-Tzvi, P.**, Ben Mrad, R., Goldenberg, A.A., "A Conceptual Design and FE Analysis of a Piezoceramic Actuated Dispensing System for Microdrops Generation in Microarray Applications", *Mechatronics Journal*, Vol. 17, Issue 1, pp. 1-13, February 2007.

## Journal Editorials

- [2] **Ben-Tzvi, P.**, Notash, L., Voglewede, P., "Special Issue: Selected Papers from IDETC 2020", *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 13, Issue 3, pp. 030301: 1-2, June 2021. DOI: 10.1115/1.4050855
- [1] Kim, C., Purwar, A., **Ben-Tzvi, P.**, "Special Issue: Selected Papers from IDETC 2019", *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 12, Issue 2, pp. 1-3, April 2020. DOI: 10.1115/1.4046177

## Patents (8 Issued/Allowed, 5 Non-provisional, 7 Abandoned)

- [20] **Ben-Tzvi, P.**, Kamidi, V., "An Articulated Closed Kinematic Chain Planar Monopod", U.S. Patent Application No. 17/813,772, Filed July 20, 2022. Published online November 24, 2022
- [19] **Ben-Tzvi, P.**, Liu, Y., Rone, W.S., Saab, W., "Articulated Multi-Link Robotic Tail Systems and Methods", U.S. Patent Application No. 17/697,353, Published June 30, 2022.
- [18] **Ben-Tzvi, P.**, Njaka, T., Brizzolara, S., "High-Speed Omnidirectional Underwater Propulsion Mechanism", U.S. Patent Application No. 17/531,007, Published December 8, 2022.
- [17] **Ben-Tzvi, P.**, Refour, E., Sebastian, B., Xu, W., Guo, Y., Pradhan, S., "Robotic Exoskeleton Glove System", U.S. Patent Application No. 16/888,993, Filed June 1, 2020.

- [16] **Ben-Tzvi, P.**, Liu, Y., "Extensible Continuum Manipulator", U.S. PCT Patent Application No. PCT/US2021/034564, Filed May 27, 2021.
- [15] **Ben-Tzvi, P.**, Kamidi, V., "Articulated Closed Kinematic Chain Planar Monopod", U.S. Patent No. 11,413,475, Issued August 16, 2022.
- [14] **Ben-Tzvi, P.**, Liu, Y., Rone, W.S., Saab, W., "Articulated Multi-Link Robotic Tail Systems and Methods", U.S. Patent 11,305,420, Issued April 19, 2022.
- [13] **Ben-Tzvi, P.**, Kumar, A., "Linear Optical Sensor Arrays (LOSA) Tracking System for Active Marker Based 3D Motion Tracking", U.S. Patent 10,295,651, Issued May 21, 2019.
- [12] **Ben-Tzvi, P.**, Moubarak, P., "Active Docking Mechanism for Modular and Reconfigurable Robots", U.S. Patent 9,616,948, Issued April 11, 2017.
- [11] **Ben-Tzvi, P.**, Goldenberg, A.A., and Zu, J.W., "Hybrid Mobile Robot", Canadian Patent No. CA2631116, Issued, September 2016.
- [10] **Ben-Tzvi, P.**, Moubarak, P., "A mobile Robot with Hybrid Traction and Mobility Mechanism", U.S. Patent 9,004,200, Issued April 14, 2015.
- [9] **Ben-Tzvi, P.**, "A Mobile Robot with Symbiosis of Locomotion and Manipulation", U.S. Patent 8,225,892, Issued July 24, 2012.
- [8] **Ben-Tzvi, P.**, Goldenberg, A.A., and Zu, J.W., "Hybrid Mobile Robot", U.S. Patent 7,874,386, Issued January 25, 2011.
- [7] **Ben-Tzvi, P.**, Yang, J., Saab, W., "Robotic Modular Leg V2 Utilizing the Reuleaux Triangle Drive Mechanism to Build Legged Mobile Robots", U.S. Provisional Patent Application No. 62/855,968, June 1, 2019. (abandoned)
- [6] **Ben-Tzvi, P.**, Williams, A., Sebastian, B., Kumar, A., Saab, W., "Semi-Autonomous Victim Extraction Robot (SAVER)", U.S. Provisional Patent Application No. 62/836,915, April 22, 2019. (abandoned)
- [5] **Ben-Tzvi, P.**, Kumar, A., "An Expandable 6D Motion Tracking System Using Linear Optical Sensors Arrays (LOSA-X)", U.S. Patent Application No. 16/356,568, Filed March 18, 2019. (abandoned)
- [4] **Ben-Tzvi, P.**, Saab, W., "Discrete Modular Serpentine Robotic Tail Mechanism for Mobile Legged Robots", U.S. Provisional Patent Application No.62/340,140, May 23, 2016. (abandoned)
- [3] **Ben-Tzvi, P.**, Saab, W., "Robotic Modular Leg Mechanism for Legged Mobile Robots", U.S. Provisional Patent Application No.62/340,136, May 23, 2016. (abandoned)
- [2] **Ben-Tzvi, P.**, "A Hybrid Suspension and Tension Mechanism for Mobile Robots", U.S. Patent Application No. 13/507,180, June 12, 2012. (abandoned)
- [1] **Ben-Tzvi, P.**, "Mobile Robot with Symbiosis of Locomotion and Manipulation", U.S. Patent Application No. 12/925,145, October 14, 2010. (abandoned)

## Peer-Reviewed Conference Proceedings (full articles with full review) <sup>1</sup>

- [99] Guo, Y., Xu, W., Bravo, C., **Ben-Tzvi, P.**, “Voice-based Human Machine Interface for Rehabilitation Exoskeleton Robotic Glove with Speaker Verification Feature Using One-shot Learning”, *Proceedings of the 2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2023)*, Detroit, Michigan, October 1-5, 2023.
- [98] Xu, W., Guo, Y., **Ben-Tzvi, P.**, “Robotic Exoskeleton Glove System Design and Simulation for Patients with Brachial Plexus Injuries”, *Proceedings of the 2023 ASME IDETC/CIE, 47th Mechanisms & Robotics Conference*, Boston, MA, August 20-23, 2023. Accepted.
- [97] Xu, W., Guo, Y., Bravo, C.J., **Ben-Tzvi, P.**, “Design, Control, and Experimental Evaluation of a Novel Robotic Glove System for Patients with Brachial Plexus Injuries”, *Proc. of the 2023 IEEE International Conference on Robotics and Automation (ICRA2023)*, London, UK, May 2-June 2, 2023.
- [96] Xu, W., Guo, Y., Bravo, C., **Ben-Tzvi, P.**, “Development and Experimental Evaluation of a Novel Portable Haptic Robotic Exoskeleton Glove System for Patients with Brachial Plexus Injuries”, *Proceedings of the 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2022)*, Kyoto, Japan, October 23-27, 2022.
- [95] Xu, W., Liu, Y., **Ben-Tzvi, P.**, “Development of a Novel Low-profile Robotic Exoskeleton Glove for Patients with Brachial Plexus Injuries”, *Proceedings of the 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2022)*, Kyoto, Japan, October 23-27, 2022.
- [94] Xu, W., Liu, Y., **Ben-Tzvi, P.**, “Design, Analysis, and Prototyping of a Novel Single DOF Index Finger Exoskeleton Mechanism”, *Proceedings of the 2022 ASME IDETC/CIE, 46th Mechanisms & Robotics Conference*, St. Louis, Missouri, August 14-17, 2022.
- [93] Pressgrove, I., Liu, Y., **Ben-Tzvi, P.**, “Design and Implementation of a Power-Dense, Modular, and Compact Serpentine Articulated Robotic Tail”, *Proceedings of the 2022 ASME IDETC/CIE, 46th Mechanisms & Robotics Conference*, St. Louis, Missouri, Aug 14-17, 2022.
- [92] Liu, Y., **Ben-Tzvi, P.**, “Systematic Development of a Novel, Dynamic, Reduced Complexity Quadruped Robot Platform for Robotic Tail Research”, *Proc. of the 2022 IEEE International Conference on Robotics and Automation (ICRA2022)*, Philadelphia, PA, pp. 4664-4670, May 23-27, 2022.
- [91] Liu, Y., **Ben-Tzvi, P.**, “Feedback Control of the Locomotion of a Tailed Quadruped Robot”, *Proceedings of the 2021 ASME IDETC/CIE, 45th Mechanisms & Robotics Conference*, Virtual, Online, Aug. 17-20, 2021.
- [90] Guo, Y., Xu, W., Pradhan, S., Bravo, C.J., **Ben-Tzvi, P.**, “Integrated and Configurable Voice Activation and Speaker Verification System for a Robotic Exoskeleton Glove”, *Proceedings of the 2020 ASME IDETC/CIE, 44th Mechanisms & Robotics Conference*, St. Louis, MO, Aug. 16-19, 2020.

---

<sup>1</sup> Although in some areas conference papers are considered non-peer reviewed publications, in my field all conference papers are peer reviewed. For example, **ICRA and IROS** are the largest robotics conferences organized by IEEE society. The acceptance rate for ICRA in 2022 was **43.1%**, **38.7%** in 2006, **44.3%** in 2007, **43%** in 2009, **41.0%** in 2010, **40.25%** in 2012, **38.5%** in 2013, **43.1%** in 2022. The acceptance rate for IROS in 2022 was **48%**, and in 2017 and 2018 **45%**. The journals IEEE Transactions on Robotics, IEEE/ASME Transactions on Mechatronics, IEEE Transactions on Neural Systems & Rehabilitation Engineering, IEEE Sensors Journal, Journal of Field Robotics, ASME Journal of Mechanical Design, and ASME Journal of Mechanisms and Robotics have the highest impact factors in my discipline (Robotics/ Mechatronics/ Design).

- [89] Xu, W., Pradhan, S., Guo, Y., Bravo, C.J., **Ben-Tzvi, P.**, "A Novel Design of a Robotic Glove System for Patients with Brachial Plexus Injuries", *Proceedings of the 2020 ASME IDETC/CIE, 44th Mechanisms & Robotics Conference*, St. Louis, MO, Aug. 16-19, 2020.
- [88] Han, X., Ren, H., **Ben-Tzvi, P.**, "Autonomous Cricothyroid Membrane Detection Using Neural Networks for First-Aid Surgical Airway Management", *Proceedings of the 2020 ASME IDETC/CIE, 44th Mechanisms & Robotics Conference*, St. Louis, MO, Aug. 16-19, 2020.
- [87] Liu, Y., **Ben-Tzvi, P.**, "A New Extensible Continuum Manipulator Using Flexible Parallel Mechanism and Rigid Motion Transmission", *Proceedings of the 2020 ASME IDETC/CIE, 44th Mechanisms & Robotics Conference*, St. Louis, MO, Aug. 16-19, 2020.
- [86] Sohal, S.S., **Ben-Tzvi, P.**, "Sensor Based Target Tracking with Application to Autonomous Docking and Self-Reconfigurability", *Proceedings of the 2020 ASME IDETC/CIE, 44th Mechanisms & Robotics Conference*, St. Louis, MO, Aug. 16-19, 2020.
- [85] Liu, Y., **Ben-Tzvi, P.**, "Maneuvering and Stabilization of Reduced Complexity Legged Robots Using Bioinspired Robotic Tails", *2019 Do Good Robotics Symposium (DGRS)*, University of Maryland, College Park, MD, Oct. 3-4, 2019.
- [84] Chauhan, R., **Ben-Tzvi, P.**, "A Series Elastic Actuator Design and Control in a Linkage Based Hand Exoskeleton", *Proceedings of the ASME 2019 Dynamic Systems and Control Conf. (DSCC 2019)*, Park City, Utah, Oct. 8-11, 2019.
- [83] Ren, H., Qi, J., **Ben-Tzvi, P.**, "Learning Flatness-Based Controller Using Neural Networks", *Proceedings of the ASME 2019 Dynamic Systems and Control Conf. (DSCC 2019)*, Park City, Utah, Oct. 8-11, 2019.
- [82] Liu, Y., **Ben-Tzvi, P.**, "A New Approach to Model the Constant Curvature Continuum Robot Dynamics", *Proceedings of the ASME 2019 Dynamic Systems and Control Conf. (DSCC 2019)*, Park City, Utah, Oct. 8-11, 2019.
- [81] Yang, J., Saab, W., **Ben-Tzvi, P.**, "A Two-DOF Bipedal Robot Utilizing the Reuleaux Triangle Drive Mechanism", *Proceedings of the 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2019)*, Macau, China, pp. 4660-4665, Nov. 3-8, 2019.
- [80] Sebastian, B., Ren, H., **Ben-Tzvi, P.**, "Neural Network Based Heterogeneous Sensor Fusion for Robot Motion Planning", *Proceedings of the 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2019)*, Macau, China, pp. 2899-2904, Nov. 3-8, 2019.
- [79] Budolak, D., Chauhan, R., **Ben-Tzvi, P.**, "Semi-Autonomous Teleoperation, Guidance, and Obstacle Avoidance with Path Adherence", *Proceedings of the 2019 ASME IDETC/CIE, 43rd Mechanisms & Robotics Conference*, Anaheim, CA, Aug. 18-21, 2019.
- [78] Sohal, S.S., **Ben-Tzvi, P.**, "Image-Based Motion Analysis for Self-Reconfigurable Mobile Robots with Integrated Docking", *Proceedings of the 2019 ASME IDETC/CIE, 43rd Mechanisms & Robotics Conference*, Anaheim, CA, Aug. 18-21, 2019.
- [77] Njaka, T., Brizzolara, S., **Ben-Tzvi, P.**, "Design and Simulation of a Novel High-Speed Omnidirectional Fully-Actuated Underwater Propulsion Mechanism", *Proceedings of the 2019 ASME IDETC/CIE, 43rd Mechanisms & Robotics Conference*, Anaheim, CA, Aug. 18-21, 2019.
- [76] Feng, S., Ren, H., Wang, X., **Ben-Tzvi, P.**, "Mobile Robot Obstacle Avoidance Based on

Deep Reinforcement Learning”, *Proceedings of the 2019 ASME IDETC/CIE, 43rd Mechanisms & Robotics Conference*, Anaheim, CA, Aug. 18-21, 2019.

- [75] Liu, Y., **Ben-Tzvi, P.**, “Design, Analysis, and Optimization of a New Two-DOF Articulated Multi-link Robotic Tail”, *Proceedings of the 2019 ASME IDETC/CIE, 43rd Mechanisms & Robotics Conference*, Anaheim, CA, Aug. 18-21, 2019.
- [74] Kamidi, V., Williams, A., **Ben-Tzvi, P.**, “A Framework for Modeling Closed Kinematic Chains with a Focus on Legged Robots”, *Proceedings of the 2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2018)*, Madrid, Spain, pp. 2733-2738, Oct. 1–5, 2018.
- [73] Saab, W., Yang, J., **Ben-Tzvi, P.**, “Modeling and Control of an Articulated Tail for Maneuvering a Reduced Degree of Freedom Legged Robot”, *Proceedings of the 2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2018)*, Madrid, Spain, pp. 2695-2700, Oct. 1–5, 2018.
- [72] Vanteddu, T., Sebastian, B., **Ben-Tzvi, P.**, “Design Optimization of RML Glove for Improved Grasp Performance”, *Proceedings of the ASME 2018 Dynamic Systems and Control Conf. (DSCC 2018)*, Atlanta, GA, Sep. 30 – Oct. 3, 2018.
- [71] Ren, H., Kumar, A., Wang, X., **Ben-Tzvi, P.**, “Parallel Deep Learning Ensembles for Human Pose Estimation”, *Proceedings of the ASME 2018 Dynamic Systems and Control Conf. (DSCC 2018)*, Atlanta, GA, Sep. 30 – Oct. 3, 2018.
- [70] Wang, J., Kamidi, V., **Ben-Tzvi, P.**, “A Multibody Toolbox for Hybrid Dynamic System Modeling Based on Nonholonomic Symbolic Formalism”, *Proceedings of the ASME 2018 Dynamic Systems and Control Conf. (DSCC 2018)*, Atlanta, GA, Sep. 30 – Oct. 3, 2018.
- [69] Chauhan, R., **Ben-Tzvi, P.**, “Latent Variable Grasp Prediction for Exoskeletal Glove Control”, *Proceedings of the ASME 2018 Dynamic Systems and Control Conf. (DSCC 2018)*, Atlanta, GA, Sep. 30 – Oct. 3, 2018.
- [68] Refour, E., Sebastian, B., **Ben-Tzvi, P.**, “Design and Implementation of an Exoskeleton Glove for Infant Medical Rehabilitation”, *Proceedings of the 2018 ASME IDETC/CIE, 42nd Mechanisms & Robotics Conference*, Quebec City, Canada, Aug. 26-29, 2018.
- [67] Sohal, S.S., Saab, W., **Ben-Tzvi, P.**, “Improved Alignment Estimation for Autonomous Docking of Mobile robots”, *Proceedings of the 2018 ASME IDETC/CIE, 42nd Mechanisms & Robotics Conference*, Quebec City, Canada, Aug. 26-29, 2018.
- [66] Liu, Y., **Ben-Tzvi, P.**, “Dynamic Modeling of a Quadruped with a Robotic Tail Using Virtual Work Principle”, *Proceedings of the 2018 ASME IDETC/CIE, 42nd Mechanisms & Robotics Conference*, Quebec City, Canada, Aug. 26-29, 2018.
- [65] Sebastian, B., Williams, A., **Ben-Tzvi, P.**, “Gaussian Kernel Controller for Path Tracking in Mobile Robots”, *Proceedings of the 2018 ASME IDETC/CIE, 42nd Mechanisms & Robotics Conference*, Quebec City, Canada, Aug. 26-29, 2018.
- [64] Lee, J., **Ben-Tzvi, P.**, “Design of a Wearable 3-DOF Forearm Exoskeleton for Rehabilitation and Assistive Purposes”, *Proceedings of the 2017 ASME International Mechanical Engineering Congress and Exposition (IMECE 2017)*, Tampa, Florida, Nov. 3–9, 2017.
- [63] Sebastian, B., Williams, A., **Ben-Tzvi, P.**, “Control of a Head Stabilization System for Use in

- Robotic Disaster Response”, *Proceedings of the 2017 ASME International Mechanical Engineering Congress and Exposition (IMECE 2017)*, Tampa, Florida, Nov. 3–9, 2017.
- [62] Rone, W., **Ben-Tzvi, P.**, “Design, Modeling and Optimization of the Universal-Spatial Robotic Tail”, *Proceedings of the 2017 ASME International Mechanical Engineering Congress and Exposition (IMECE 2017)*, Tampa, Florida, Nov. 3–9, 2017.
- [61] Kumar, A., **Ben-Tzvi, P.**, “An Inertial Sensor to Measure Wind Turbulence with RC Helicopters”, *Proceedings of the ASME 2017 Dynamic Systems and Control Conf. (DSCC 2017)*, Tysons Corner, VA, Oct 11-13, 2017.
- [60] Saab, W., **Ben-Tzvi, P.**, “Maneuverability and Heading Control of a Quadruped Robot Utilizing Tail Dynamics”, *Proceedings of the ASME 2017 Dynamic Systems and Control Conf. (DSCC 2017)*, Tysons Corner, VA, Oct 11-13, 2017.
- [59] Kumar, A., Ren, H., **Ben-Tzvi, P.**, “Obstacle Identification for Vision Assisted Control Architecture of a Hybrid Mechanism Mobile Robot”, *Proceedings of the ASME 2017 Dynamic Systems and Control Conf. (DSCC 2017)*, Tysons Corner, VA, Oct 11-13, 2017.
- [58] Kamidi, V., Saab, W., **Ben-Tzvi, P.**, “Design And Analysis of a Novel Planar Robotic Leg For High-Speed Locomotion”, *Proceedings of the 2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2017)*, Vancouver, Canada, pp. 6343–6348, Sep. 24–28, 2017.
- [57] Rone, W., **Ben-Tzvi, P.**, “Maneuvering and Stabilizing Control of a Quadrupedal Robot using a Serpentine Robotic Tail”, *2017 IEEE Conference on Control Technology and Applications*, Kohala Coast, Hawai’i, pp. 1763–1768, Aug. 27–30, 2017.
- [56] Racioppo, P., **Ben-Tzvi, P.**, “Modeling and Control of a Cable Driven Modular Snake Robot”, *2017 IEEE Conference on Control Technology and Applications*, Kohala Coast, Hawai’i, pp. 468–473, Aug. 27–30, 2017.
- [55] Williams, A., Saab, W., **Ben-Tzvi, P.**, “Analysis of Differential Mechanisms for a Robotic Head Stabilization System”, *Proceedings of the 2017 ASME IDETC/CIE, 41st Mechanisms & Robotics Conference*, Cleveland, Ohio, Aug. 6-9, 2017.
- [54] Refour, E., Sebastian, B., **Ben-Tzvi, P.**, “Design and Integration of a Two-Digit Exoskeleton Glove”, *Proceedings of the 2017 ASME IDETC/CIE, 41st Mechanisms & Robotics Conference*, Cleveland, Ohio, Aug. 6-9, 2017.
- [53] Racioppo, P., Saab, W., **Ben-Tzvi, P.**, “Design and Analysis of Reduced Degree-of-Freedom Modular Snake Robot”, *Proceedings of the 2017 ASME IDETC/CIE, 41st Mechanisms & Robotics Conference*, Cleveland, Ohio, Aug. 6-9, 2017.
- [52] Kumar, P., Saab, W., **Ben-Tzvi, P.**, “Design of a Multi-Directional Hybrid-Locomotion Modular Robot with Feedforward Stability Control”, *Proceedings of the 2017 ASME IDETC/CIE, 41st Mechanisms & Robotics Conference*, Cleveland, Ohio, Aug. 6-9, 2017.
- [51] Burns, C., Francom, M., Repisky, P., Kinney, A., Medina, B., Tello, E., **Ben-Tzvi, P.**, “Development of Autonomous Robotic Cataract Surgery Device”, *Proceedings of the 2016 ASME IDETC/CIE, 40th Mechanisms & Robotics Conference*, Charlotte, North Carolina, Aug. 21-24, 2016.
- [50] Saab, W., **Ben-Tzvi, P.**, “Design and Analysis of a Miniature Modular Inchworm Robot”,

*Proceedings of the 2016 ASME IDETC/CIE, 40th Mechanisms & Robotics Conference, Charlotte, North Carolina, Aug. 21-24, 2016.*

- [49] Saab, W., **Ben-Tzvi, P.**, "Design and Analysis of a Discrete Modular Robotic Tail for Improved Performance of Mobile Robots", *Proceedings of the 2016 ASME IDETC/CIE, 40th Mechanisms & Robotics Conference, Charlotte, North Carolina, Aug. 21-24, 2016.*
- [48] Saab, W., **Ben-Tzvi, P.**, "Design and Analysis of a Robotic Modular Leg Mechanism", *Proceedings of the 2016 ASME IDETC/CIE, 40th Mechanisms & Robotics Conference, Charlotte, North Carolina, Aug. 21-24, 2016.*
- [47] Kumar, A., **Ben-Tzvi, P.**, "Extraction of Impact of Wind Turbulence on RC Helicopters using Machine Learning", *Proceedings of the 2016 ASME IDETC/CIE, 40th Mechanisms & Robotics Conference, Charlotte, North Carolina, Aug. 21-24, 2016.*
- [46] Saab, W., **Ben-Tzvi, P.**, "Development of a Novel Coupling Mechanism for Modular Self-Reconfigurable Mobile Robots", *Proceedings of the 2015 ASME IDETC/CIE, 39th Mechanisms & Robotics Conference, Boston, MA, Aug. 2-5, 2015.*
- [45] Rone, W., **Ben-Tzvi, P.**, "Static Modeling of a Multi-Segment Serpentine Robotic Tail", *Proceedings of the 2015 ASME IDETC/CIE, 39th Mechanisms & Robotics Conference, Boston, MA, Aug. 2-5, 2015.*
- [44] Ma, Z., **Ben-Tzvi, P.**, Danoff, J., "Sensing and Force-Feedback Exoskeleton Robotic (SAFER) Glove Mechanism for Hand Rehabilitation", *Proceedings of the 2015 ASME IDETC/CIE, 39th Mechanisms & Robotics Conference, Boston, MA, Aug. 2-5, 2015.*
- [43] Kumar, A., **Ben-Tzvi, P.**, Snyder, M.R., "UAV-based Wireless Telemetry System for the Estimation of Ship Air Wake Patterns", *Proc. of the 2015 ASME IDETC/CIE, 2015 ASME/IEEE International Conference on Mechatronic and Embedded Systems and Applications, Boston, MA, Aug. 2-5, 2015.*
- [42] Ma, Z., **Ben-Tzvi, P.**, "Modeling Human Hand and Sensing Hand Motions with the Five-Fingered Haptic Glove Mechanism", *Proc. of the 2014 ASME Int'l Design Engineering Technical Conferences & Computers and Information in Engineering Conf. (IDETC/CIE 2014), 38th Mechanisms & Robotics Conference, Buffalo, NY, Aug. 17-20, 2014.*
- [41] Rone, W., **Ben-Tzvi, P.**, "Continuum Robotic Tail Loading Analysis for Mobile Robot Stabilization and Maneuvering", *Proceedings of the 2014 ASME Int'l Design Engineering Technical Conferences & Computers and Information in Engineering Conf. (IDETC/CIE 2014), 38th Mechanisms & Robotics Conference, Buffalo, NY, Aug. 17-20, 2014.*
- [40] Snyder, M.R., Kumar, A., **Ben-Tzvi, P.**, "Off Ship Measurement of Ship Air Wakes Using Instrumented Unmanned Aerial Vehicles", *32nd AIAA Applied Aerodynamics Conference, AIAA Aviation and Aeronautics Forum and Exposition 2014, AIAA Paper 2014-3100, Atlanta, GA, 16-20 June 2014.*
- [39] Rone, W., **Ben-Tzvi, P.**, "Multi-Segment Continuum Robot Shape Estimation Using Passive Cable Displacements", *Proceedings of the 2013 IEEE International Symposium on Robotic and Sensors Environments (ROSE 2013), Washington, DC, pp. 37-42, Oct. 21-23, 2013.*
- [38] Ma, Z., **Ben-Tzvi, P.**, "Tendon Transmission Efficiency of A Two-finger Haptic Glove", *Proceedings of the 2013 IEEE International Symposium on Robotic and Sensors Environments (ROSE 2013), Washington, DC, pp. 13-18, Oct. 21-23, 2013.*

- [37] Kumar, A., **Ben-Tzvi, P.**, Snyder, M.R., Saab, W., "Instrumentation System for Ship Airwake Measurement", *Proceedings of the 2013 IEEE Int'l Symposium on Robotic and Sensors Environments (ROSE 2013)*, Washington, DC, pp. 118–123, Oct. 21-23, 2013.
- [36] Moubarak, P., Alvarez, E., **Ben-Tzvi, P.**, "Reconfiguring a Modular Robot into a Humanoid Formation: A Multi-Body Dynamic Perspective on Motion Scheduling for Modules and their Assemblies", *Proc. of the 2013 IEEE International Conference on Automation Science and Engineering (CASE2013)*, Madison, Wisconsin, pp. 687–692, Aug. 17-21, 2013.
- [35] Moubarak, P., **Ben-Tzvi, P.**, "Globally Converging MIMO Optimal Controller for Adaptive Manipulation of Mobile Robots with Redundant Arms", *Proceedings of the 2013 American Control Conference*, Washington, DC, pp. 5729–5734, June 17–19, 2013.
- [34] Moubarak, P., **Ben-Tzvi, P.**, Ma, Z., Alvarez, E., "An Active Coupling Mechanism with Three Modes of Operation for Modular Mobile Robotics", *Proc. of the 2013 IEEE International Conference on Robotics and Automation (ICRA2013)*, Karlsruhe, Germany, pp. 5469–5474, May 6-10, 2013.
- [33] Snyder, M.R., Kumar, A., **Ben-Tzvi, P.**, Kang, H.S., "Validation of Computational Ship Air Wakes for a Naval Research Vessel", *American Institute of Aeronautics and Astronautics (AIAA) 51<sup>st</sup> Aerospace Sciences Meeting*, AIAA Paper 2013-0959, Grapevine, Texas, January 7-10, 2013. DOI: 10.2514/6.2013-959
- [32] Rone, W., **Ben-Tzvi, P.**, "Continuum Manipulator Statics Based on the Principle of Virtual Work", *Proceedings of the 2012 ASME International Mechanical Engineering Congress and Exposition (IMECE 2012)*, Houston, TX, pp. 321-328, November 9–15, 2012.
- [31] Moubarak, P., **Ben-Tzvi, P.**, Ma, Z., Alvarez, E., "Kinematic Synthesis and Dynamic Analysis of the Dual-Rod Slider Crank Mechanism: An Application to Modular Robotics", *Proceedings of the 2012 ASME IDETC/CIE, 36th Mechanisms & Robotics Conference*, Chicago, IL, pp. 1073-1078, Aug. 12–15, 2012.
- [30] Ma, Z., **Ben-Tzvi, P.**, "An Admittance Glove Mechanism for Controlling a Mobile Robot", *Proceedings of the 2012 ASME IDETC/CIE, 36th Mechanisms & Robotics Conference*, Chicago, IL, pp. 1109-1114, Aug. 12–15, 2012.
- [29] Moubarak, P., Barsky, D., **Ben-Tzvi, P.**, Zaghloul, M., "A Self-Calibrating Temperature Independent Model of a Bi-Axial Piezoelectric MEMS Tilt Sensor," *Proceedings of SPIE - Defense, Security, and Sensing, Micro- and Nanotechnology Sensors, Systems, and Applications IV Conference*, Vol. 8373, 83732L-1, Baltimore, MD, April 23-27, 2012.
- [28] Gilman, C., **Ben-Tzvi, P.**, Yessin, G., Danoff, J., "A Robotic Wrist Exoskeleton Device for Augmenting Wrist Movement and Grip Function in Debilitated Patients", *Proceedings of the 2011 ASME International Mechanical Engineering Congress and Exposition (IMECE 2011)*, Denver, CO, pp. 1041-1050, November 11–17, 2011.
- [27] Ma, Z., **Ben-Tzvi, P.**, "An Admittance Type Haptic Device: RML Glove", *Proceedings of the 2011 ASME International Mechanical Engineering Congress and Exposition (IMECE 2011)*, Denver, CO, pp. 1219-1226, November 11–17, 2011.
- [26] Gilani, O., **Ben-Tzvi, P.**, "Bioinspired Jumping Mobility Concepts for Rough Terrain Mobile Robots", *Proceedings of the 2011 ASME International Mechanical Engineering Congress and Exposition (IMECE 2011)*, Denver, CO, pp. 207-214, November 11–17, 2011.

- [25] Gilani, O., **Ben-Tzvi, P.**, "The Application of Bipinspired Jumping Locomotion Principles to Mobile Robots: Modeling and Analysis", *Proceedings of the 2011 ASME Annual Dynamic Systems and Control Conf. (DSCC 2011)*, Arlington, VA, pp. 427-434, Oct 31–Nov 2, 2011.
- [24] Rone, W., **Ben-Tzvi, P.**, "MEMS-Based Microdroplet Generation with Integrated Sensing", *COMSOL Conference*, Boston, MA, October 13-15, 2011.  
\*\*\* **Winner of the Best Paper Award** \*\*\*
- [23] Moubarak, P., **Ben-Tzvi, P.**, "Design and Analysis of a New Piezoelectric MEMS Tilt Sensor", *Proceedings of the 2011 IEEE International Symposium on Robotic and Sensors Environments (ROSE 2011)*, Montreal, Quebec, Canada, pp. 83–88, Sep. 17-18, 2011.
- [22] Moubarak, P., **Ben-Tzvi, P.**, "Adaptive Manipulation of a Hybrid Mechanism Mobile Robot", *Proceedings of the 2011 IEEE International Symposium on Robotic and Sensors Environments (ROSE 2011)*, Montreal, Quebec, Canada, pp. 113–118, Sep. 17-18, 2011.
- [21] Rone, W., **Ben-Tzvi, P.**, "Finite Element Modeling of a Microdroplet Generator with Integrated Sensing", *Proceedings of the 2011 ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE 2011)*, 2011 ASME/IEEE International Conference on Mechatronic and Embedded Systems and Applications (MESA2011), Washington, DC, Aug. 28–31, 2011.
- [20] Moubarak, P., **Ben-Tzvi, P.**, Ma, Z., Dumas, M., "A Mobile Robotic Platform for Autonomous Navigation and Dexterous Manipulation in Unstructured Environments", *Proceedings of the 2010 ASME International Mechanical Engineering Congress and Exposition (IMECE 2010)*, Vancouver, British Columbia, Canada, November 12–18, 2010.
- [19] **Ben-Tzvi, P.**, Zhuk, M., "Real-time Dynamic Modeling and Virtual Prototype Simulation of Mechanical systems", *Proceedings of the 2010 ASME International Mechanical Engineering Congress and Exposition (IMECE 2010)*, Vancouver, British Columbia, Canada, November 12–18, 2010.
- [18] Charifa, S., **Ben-Tzvi, P.**, "Using Backpropagation Neural Network in Object Recognition for Hybrid Mechanism Mobile Robot", *Proceedings of the 2010 ASME International Mechanical Engineering Congress and Exposition (IMECE 2010)*, Vancouver, British Columbia, Canada, November 12–18, 2010.
- [17] Moubarak, P., **Ben-Tzvi, P.**, and Ma, Z., "A Generic Configuration of a Compact Dexterous and Self-Contained End-Effector for Mobile Robotic Platforms", *Proceedings of the 2010 IEEE International Workshop on Robotic and Sensors Environments (ROSE 2010)*, Phoenix, Arizona, pp. 116–121, October 15-16, 2010.
- [16] **Ben-Tzvi, P.**, Xu, X., "An Embedded Feature-Based Stereo Vision System for Autonomous Mobile Robots", *Proceedings of the 2010 IEEE International Workshop on Robotic and Sensors Environments (ROSE 2010)*, Phoenix, Arizona, pp. 176–181, October 15-16, 2010.
- [15] **Ben-Tzvi, P.**, Charifa, S., Shick, M., "Extraction of 3D Images Using Pitch-Actuated 2D Laser Range Finder for Robotic Vision", *Proceedings of the 2010 IEEE International Workshop on Robotic and Sensors Environments (ROSE 2010)*, Phoenix, Arizona, pp. 140–145, October 15-16, 2010.
- [14] Zhou, Q., **Ben-Tzvi, P.**, Iqbal, A., Fan, D., "Design, Analysis and Optimization of Magnetic Microactuators", *Proceedings of the 2009 ASME Int'l Mechanical Engineering Congress and Exposition (IMECE 2009)*, Lake Buena Vista, Florida, pp. 503-512, Nov. 13-19, 2009.

- [13] Bai, S., **Ben-Tzvi, P.**, Zhou, Q., Huang, X., "Fuzzy Sliding Mode Control of Flexible Spacecraft with Input Saturation", *Proceedings of the 2009 ASME International Mechanical Engineering Congress and Exposition (IMECE 2009)*, Lake Buena Vista, Florida, pp. 1055-1061, November 13-19, 2009.
- [12] **Ben-Tzvi, P.**, "Experimental Validation of a Hybrid Mobile Robot Mechanism with Interchangeable Locomotion and Manipulation", *Proceedings of the 2009 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2009)*, St. Louis, Missouri, pp. 420-421, October 11-15, 2009.
- [11] **Ben-Tzvi, P.**, "Wireless Modular Control Hardware Architecture for Hybrid Mechanism Mobile Robot", *Proceedings of the 2009 ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conf. (IDETC/CIE 2009)*, 33rd Mechanisms & Robotics Conference, San Diego, CA, pp. 675-680, Aug. 30-Sep. 2, 2009.
- [10] Zhao, H., **Ben-Tzvi, P.**, Tingqi Lin, T., Goldenberg, A.A., "Two-layer Sliding Mode Control of Pneumatic Position Synchro System with Feedback Linearization Based on Friction Compensation", *Proceedings of the 2008 IEEE International Workshop on Robotic and Sensors Environments (ROSE 2008)*, Ottawa, ON, Canada, pp. 41-45, Oct 17-18, 2008.
- [9] Zhou, Q., **Ben-Tzvi, P.**, Fan, D., Goldenberg, A.A., "Design of Fast Steering Mirror Systems for Precision Laser Beams Steering", *Proceedings of the 2008 IEEE International Workshop on Robotic and Sensors Environments (ROSE 2008)*, Ottawa, Ontario, Canada, pp. 144-149, October 17-18, 2008.
- [8] Bai, S., **Ben-Tzvi, P.**, Zhou, Q., Huang, X., "Dynamic Modeling of a Rotating Beam Having a Tip Mass", *Proceedings of the 2008 IEEE International Workshop on Robotic and Sensors Environments (ROSE 2008)*, Ottawa, Ontario, Canada, pp. 52-57, October 17-18, 2008.
- [7] **Ben-Tzvi, P.**, Goldenberg, A.A., and Zu, J.W., "Design, Simulations and Optimization of a Tracked Mobile Robot Manipulator with Hybrid Locomotion and Manipulation Capabilities", *Proceedings of the 2008 IEEE International Conference on Robotics and Automation (ICRA2008)*, Pasadena, California, pp. 2307-2312, May 19-23, 2008.
- [6] **Ben-Tzvi, P.**, Goldenberg, A.A., "Mobile Robots for Hazardous Environments: New Technology for Mobility", *ANS 2nd Int. Joint Topical Meeting on Emergency Preparedness & Response and Robotic & Remote Systems (12th Robotics & Remote Systems for Hazardous Environments)*, Albuquerque, NM, Mar 9-12, 2008.
- [5] Raoufi, C., **Ben-Tzvi, P.**, Goldenberg, A.A., and Kucharczyk, W., "A MR-Compatible Tele-Robotic System for MRI-Guided Intervention: System Overview and Mechanical Design", *Proceedings of the 2007 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2007)*, San Diego, California, pp. 1975-1800, October 29 - Nov 2, 2007.
- [4] **Ben-Tzvi, P.**, Goldenberg, A.A., and Zu, J.W., "Implementation of Sensors and Control Paradigm for a Hybrid Mobile Robot Manipulator for Search and Rescue Operations", *Proceedings of the 2007 IEEE International Workshop on Robotic and Sensors Environments (ROSE 2007)*, Ottawa, Ontario, Canada, pp. 92-97, October 12-13, 2007.  
\*\*\* **Winner of the Best Student Paper Award** \*\*\*
- [3] **Ben-Tzvi, P.**, Ito, S., and Goldenberg, A.A., "Autonomous Stair Climbing with Reconfigurable Tracked Mobile Robot", *Proceedings of the 2007 IEEE International Workshop on Robotic and Sensors Environments (ROSE 2007)*, Ottawa, Canada, pp. 104-

109, October 12–13, 2007.

- [2] **Ben-Tzvi, P.**, Raoufi, C., Goldenberg, A.A., Zu, J.W., “Virtual Prototype Development and Simulations of a Tracked Hybrid Mobile Robot”, *Proceedings of MSC Software 2007 Virtual Product Development Conference*, Detroit, Michigan, October 10–12, 2007.
- [1] **Ben-Tzvi, P.**, Goldenberg, A.A., Zu, J.W., “A Novel Control Architecture and Design of Hybrid Locomotion and Manipulation Tracked Mobile Robot”, *Proceedings of the 2007 IEEE International Conference on Mechatronics and Automation (ICMA 2007)*, Harbin, China, pp. 1374–1381, August 5–8, 2007.

### Magazine / Letter / Newsletter Publications

- [2] **Ben-Tzvi, P.**, Liu, Y., "Robots with Tails", *Mechanical Engineering Magazine*, Vol. 143, Issue 6, pp. 32-37, October 2021.
- [1] **Ben-Tzvi, P.**, Rone, W., "Tiny Robots, Massive Potential", *IEEE Nanotechnology Newsletter*, pp. 4-7, March 2011.

### Peer-Reviewed Abstracts

- [8] Feng, S., **Ben-Tzvi, P.**, “A Modular Robotic System with Self-Reconfiguration Strategy”, *Southeast Control Conference 2021 (SECC 2021)*, Blacksburg, VA, November 29-30, 2021.
- [7] Xu, W., **Ben-Tzvi, P.**, “Data Driven Calibration and Model-based Backlash Compensation of Compact Series Elastic Actuators for Robotic Exoskeleton Gloves”, *Southeast Control Conference 2021 (SECC 2021)*, Blacksburg, VA, November 29-30, 2021.
- [6] Pressgrove, I., **Ben-Tzvi, P.**, “Development of a Compact and Easily Packageable Serpentine Robotic Tail System”, *Southeast Control Conference 2021 (SECC 2021)*, Blacksburg, VA, November 29-30, 2021.
- [5] Liu, Y., **Ben-Tzvi, P.**, “Towards Dynamic Locomotion of Legged Robots Using Biomimetic Articulated Robotic Tails”, *2021 Annual Symposium of the Society for Integrative and Comparative Biology (SICB 2021)*, Washington, DC, January 3-7, 2021.
- [4] Fisher, N., Gilbert, G., German, S., **Ben-Tzvi, P.**, “Toward Robotic-Assisted Casualty Extraction in Multi-Domain Operations”, *Military Health System Research Symposium (MHSRS 2019)*, Kissimmee FL, August 2019.
- [3] Rone, W.S., **Ben-Tzvi, P.**, “Design and Control of Bioinspired Articulated Robotic Tails for Stabilization and Maneuvering of Legged Robots”, *Robotics Science and Systems (RSS 2018)*, Pittsburgh, PA, June 26–30, 2018.
- [2] Rone, W.S., Saab, W., **Ben-Tzvi, P.**, “Serpentine Robotic Tails for Maneuvering and Stabilizing Mobile Robots”, *Proceedings of the 2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2017)*, Vancouver, Canada, pp. 5487, Sep. 24–28, 2017.
- [1] Kamidi, V., **Ben-Tzvi, P.**, “Experimental Validation of Dynamic Legged Locomotion Utilizing a Single-DOF Robotic Leg”, *Proceedings of the 2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2017)*, Vancouver, Canada, pp. 5504, Sep. 24–28, 2017.

## Monographs/Books

- [2] **Ben-Tzvi, P.**, Hybrid Mobile Robot Systems: Symbiosis of Locomotion and Manipulation. Germany: LAP LAMBERT Academic Publishing, 2010 (ISBN-13: 978-3-8433-6890-2)
- [1] **Ben-Tzvi, P.**, A Dispensing System for Microdrops Generation in Medical Applications. Germany: LAP LAMBERT Academic Publishing, 2010 (ISBN-13: 978-3-8383-6000-3)

## Book Chapters

- [1] **Ben-Tzvi, P.**, Moubarak, P., "A Mechatronic Perspective on Robotic Arms and End-Effectors" in Intelligent Mechatronics. Vienna, Austria: InTech Open Access Publisher, 28 Feb. 2011, pp. 3–20. (ISBN-13: 978-953-307-300-2, DOI: 10.5772/16234)  
**Note: this book chapter has been downloaded over 7197 times as of December 2016.**

## Refereed Conference Posters / Video Proceedings

- [6] Kamidi, V., **Ben-Tzvi, P.**, "Experimental Validation of Dynamic Legged Locomotion Utilizing a Single-DOF Robotic Leg", *Proceedings of the 2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2017)*, Vancouver, Canada, Sep. 24–28, 2017 – Poster Presentation.
- [5] Rone, W.S., Saab, W., **Ben-Tzvi, P.**, "Serpentine Robotic Tails for Maneuvering and Stabilizing Mobile Robots", *Proceedings of the 2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2017)*, Vancouver, Canada, Sep. 24–28, 2017 – Poster Presentation.
- [4] Moubarak, P., Ma, Z., **Ben-Tzvi, P.**, "A Tri-state Rigid Reversible and Non-Back-Drivable Docking Mechanism for Modular Robotics Applications," *Proceedings of the 2012 ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE 2012)*, 36th Mechanisms & Robotics Conference, Chicago, IL, Aug. 12–15, 2012 – Poster Presentation.  
**\*\*\* Second place winner of the Graduate Robotics & Mechanisms Category\*\*\***
- [3] Moubarak, P., Barsky, D., **Ben-Tzvi, P.**, Zaghloul, M., "A Self-Calibrating Temperature Independent Model of a Bi-Axial Piezoelectric MEMS Tilt-Sensor," *Proceedings of SPIE - Defense, Security, and Sensing, Micro- and Nanotechnology Sensors, Systems, & Applications IV Conf.*, Vol. 8373-93, Baltimore, MD, April 23-27, 2012 – Poster Presentation.
- [2] Rone, W., **Ben-Tzvi, P.**, "MEMS-Based Microdroplet Generation with Integrated Sensing", *COMSOL Conference*, Boston, MA, October 13-15, 2011 – Poster Presentation.
- [1] **Ben-Tzvi, P.**, Cole, K, Gilman, C., Goktas, H., Haque, S., Ma, Z., Moubarak, P., Ouellette, J., Rone, W., Sharathi, S., Torrey, J., Zambrana, E., "RAIL: Robotic Arm for Interactive Learning", *Proceedings of the 2011 ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE 2011)*, Washington, DC, Aug. 28–31, 2011 – Poster Presentation.  
**\*\*\* Third place winner of the Graduate Robotics & Mechanisms Category\*\*\***

## Invited Keynote Lectures / Research Presentations and Seminars

- [29] *Novel Field Robots and Robotic Exoskeletons: Design, Control and Applications*, University of Virginia, Department of Mechanical and Aerospace Engineering, Charlottesville, VA, March 30, 2023. (Invited Research Presentation)

- [28] *Novel Field Robots and Robotic Exoskeletons: Design, Integration and Applications*, Florida State University, Department of Mechanical Engineering, Tallahassee, FL, May 5, 2022. (Invited Research Presentation)
- [27] *Novel Field Robots and Robotic Exoskeletons: Design, Integration and Applications*, Northeastern University, Department of Mechanical and Industrial Engineering, Boston, MA, February 28, 2022. (Invited Research Presentation)
- [26] Towards Dynamic Locomotion of Legged Robots Using Biomimetic Articulated Robotic Tails, *2021 Annual Symposium of the Society for Integrative and Comparative Biology (SICB 2021)*, Washington, DC, January 3-7, 2021. (**Invited Symposium Speaker**)
- [25] *Novel Field Robots and Robotic Exoskeletons: Design, Integration and Applications*, 2020 SPIE Smart Structures and Nondestructive Evaluation (EAPAD 2020) Conference, Anaheim, CA, April 26-30, 2020. (**Keynote Presentation**)
- [24] *Novel Field Robots and Robotic Exoskeletons: Design, Integration and Applications*, Stevens Institute of Technology, Department of Mechanical Engineering, Hoboken, NJ, February 8, 2019. (Invited Research Presentation)
- [23] *Novel Field Robots and Robotic Exoskeletons: Design, Integration and Applications*, University of Waterloo, Department of Mechanical and Mechatronics Engineering, Waterloo, Ontario, Canada, January 18, 2019. (Invited Research Presentation)
- [22] *Design and Control of Bioinspired Articulated Robotic Tails for Stabilization and Maneuvering of Legged Robots*, Carnegie Mellon University, *Robotics Science and Systems Conference (RSS 2018)*, Pittsburgh, PA, June 26–30, 2018. (Invited Workshop Presentation on “Unusual Appendages: Novel, multi-modal, or multi-functional uses for limbs, tails, and other body parts”)
- [21] *Novel Field Robots and Robotic Exoskeletons: Design, Integration and Applications*, The Jet Propulsion Laboratory (JPL), California Institute of Technology, Pasadena, CA, March 4-6, 2018. (Invited Research Presentation)
- [20] *Recent Trends on Modeling and Integration of Novel Field Robots and Robotic Exoskeletons and Their Applications*, 2018 International Conference on Mechatronics Systems and Control Engineering (ICMSCE 2018), Amsterdam, Netherlands, February 21-23, 2018. (**Keynote Lecture**)
- [19] *Integrating Novel Field Robots and Robotic Exoskeletons of the Future*, Maxon Precision Motors, Inc. Annual Executive Meeting, Washington, DC, June 1, 2016. (Invited Research Presentation)
- [18] *Novel Field Robots and Robotic Exoskeletons: Design, Integration and Applications*, University of Toronto, Department of Mechanical and Industrial Engineering, Toronto, ON, Canada, February 26, 2016. (**Distinguished Seminar Series** – Research Presentation)
- [17] *Novel Field Robots and Robotic Exoskeletons: Design, Integration and Applications*, Vanderbilt University, Department of Mechanical Engineering, Nashville, Tennessee, October 19, 2015. (Invited Research Presentation)
- [16] *Intelligent Biomimetic Flexible Robots for Stabilizing and Agile Maneuvering of Legged Robots*, Virginia Tech, Center for Bioinspired Science and Technology (BIST), Blacksburg,

VA, October 9, 2015. (Research Presentation)

- [15] *Novel Field Robots and Robotic Exoskeletons: Design, Integration and Applications*, Virginia Tech, Virginia Center for Autonomous Systems (VaCAS), Blacksburg, VA, October 9, 2015. (Invited Research Presentation)
- [14] *Design and Integration of Novel Field Robots and Robotic Exoskeletons*, University of Maryland, Maryland Robotics Center, Department of Mechanical Engineering, College Park, MD, April 24, 2015. (Invited Research Presentation)
- [13] *Design and Integration of Novel Field Robots and Robotic Exoskeletons*, State University of New York at Buffalo (UB), Mechanical and Aerospace Engineering Department, Buffalo, NY, March 12, 2015. (Invited Research Presentation)
- [12] *Design and Integration of Novel Field Robots and Robotic Exoskeletons*, Worcester Polytechnic Institute, Mechanical Engineering Department, Robotics Engineering Department, Worcester, MA, March 9, 2015. (Invited Research Presentation)
- [11] *Design and Integration of Novel Field Robots and Robotic Exoskeletons*, Virginia Tech, Department of Mechanical Engineering, Blacksburg, VA, March 2, 2015. (Invited Research Presentation)
- [10] *Design and Integration of Novel Field Robots and Robotic Exoskeletons*, University of California, San Diego, Department of Mechanical & Aerospace Engineering, San Diego, CA, February 27, 2015. (Invited Research Presentation)
- [9] *Symbiosis of Mobile Robotic Locomotion and Manipulation on Rough Terrain - Towards Modularity and Reconfigurability*, State University of New York at Buffalo (UB), Mechanical and Aerospace Engineering Department, Buffalo, NY, February 28, 2013. (Invited Research Presentation)
- [8] *Autonomous Symbiosis of Mobile Robotic Locomotion and Manipulation on Rough Terrain*, DARPA Defense Sciences Office Maximum Mobility and Manipulation (M3) Conference, Philadelphia, Pennsylvania, July 17-18, 2012. (Invited Research Presentation)
- [7] *STORM: Self-configurable and Transformable Omni-directional Robotic Modules for Rough Terrain Maximum Mobility and Manipulation*, Carnegie Mellon University (CMU), Robotics Institute, Pittsburgh, PA, March 5, 2012. (Invited Research Presentation)
- [6] *Autonomous Symbiosis of Mobile Robotic Locomotion and Manipulation on Rough Terrain*, DARPA Defense Sciences Office Maximum Mobility and Manipulation (M3) Conference, Miramar Beach, FL, January 24-25, 2012. (Invited Research Presentation)
- [5] *Symbiosis of Mobile Robotic Locomotion and Manipulation on Rough Terrain*, 2011 Symposium on Advanced Intelligent Systems, University of Waterloo, Waterloo, Canada, December 1-2, 2011. (**Keynote Lecture**)
- [4] *Sensor-Controlled Autonomous Compounded Manipulation and Locomotion of Mobile Robots*, Örebro University, School of Science and Technology, Centre for Applied Autonomous Sensor Systems (AASS), Sweden, September 10, 2008. (Research Talk)
- [3] *Autonomous Mobile Manipulation for Rough-Terrain Environments*, Mälardalen University, Intelligent Sensor Systems Division, Eskilstuna, Sweden, Sep. 11, 2008. (Research Talk)
- [2] *Hybrid Mobile Robot System for Field Operations: Interchanging Locomotion and*

*Manipulation*, Robotdalen Day, Volvo CE Democenter, Eskilstuna, Sweden, Sep 10, 2008.  
(Research Presentation)

- [1] *Wireless Hybrid Mobile Robot system: Adaptive and Interchanging Locomotion and Manipulation*, The George Washington University, Washington, DC, March 2008. (Invited Research Presentation)

### **Outreach Presentations (in my role as Program Director at NSF)**

- [1] *Navigating Research Funding Opportunities in the Established Program to Stimulate Competitive Research (EPSCoR)*, Mississippi State University, National Science Foundation (NSF) Days, Starkville, Mississippi, November 21-22, 2022.

### **Other Conference /Scholarly/Technical Presentations**

- [1] Guo, Y., Xu, W., **Ben-Tzvi, P.**, "Medical Robotic Exoskeleton Glove Designed for Patients with Hand Disabilities", *2022 Association for Uncrewed Vehicle Systems International (AUVSI) Ridge & Valley Conference: Partnerships for Autonomy*, Blacksburg, VA, October 25, 2022.
- [2] **Ben-Tzvi, P.**, "Field Performance of an Articulated Mobile Manipulator for Rough Terrain Applications", *Association for Unmanned Vehicle Systems International (AUVSI) Conference*, Denver, CO, August 24–27, 2010.
- [3] **Ben-Tzvi, P.**, "Mobile Robots for Security and Defense", *National Defense Industrial Association (NDIA) 2010 Ground Robotics Capabilities Conference & Exposition*, Miami, FL, March 16–18, 2010.
- [4] **Ben-Tzvi, P.**, "Demonstrations of a Mobile Robot with Compounded Mobility and Manipulation Capabilities", *Robotics Technology Consortium (RTC) Annual Meeting*, Miami, Florida, March 16, 2010.
- [5] **Ben-Tzvi, P.**, "Experimental Validation and Performance Metrics of a Hybrid Mechanism Mobile Robot", *Standard Test Methods for Response Robots Meeting, ASTM International Committee on Homeland Security Applications, National Institute of Standards and Technology (NIST), Intelligent Systems Division*, Gaithersburg, MD, June 8–10, 2009.
- [6] **Ben-Tzvi, P.**, "Field Performance Metrics of a Novel Hybrid Mobile Robot System", *National Institute of Standards and Technology (NIST), Intelligent Systems Division*, Gaithersburg, MD, March 16, 2009.
- [7] **Ben-Tzvi, P.**, "Swarms of Autonomously Self-Assembling Mobile Robots for Search & Rescue Missions", *National Science Foundation (NSF), Robust Intelligence Cluster, Information and Intelligent Systems*, Arlington, Virginia, February 27, 2009.
- [8] **Ben-Tzvi, P.**, "Proposal for Study on Autonomous Coupling of Navigation & Locomotion for a Hybrid Mechanism Mobile Robot", *Defense Advanced Research Projects Agency (DARPA), Information Processing Techniques Office (IPTO)*, Arlington, Virginia, Jan. 23, 2009.
- [9] **Ben-Tzvi, P.**, Goldenberg, A.A., "Mobile Robots with Hybrid Configuration for Military and Security Applications," *3rd Annual Conference on Robotics and Unmanned Systems*, Washington, DC, May 16-18, 2007.
- [10] **Ben-Tzvi, P.**, Ben Mrad, R., Goldenberg, A.A., "A Dispensing System for Microdrops

Generation in Genomics and Proteomics Applications”, *MMO Partnership Conference 2004*, Toronto Congress Centre, Toronto, Ontario, June 22, 2004.

## Technical Reports

- [1] *Self-driving Modular AI-based Robot for Rough Terrain (SMARRT)*, Defense Advanced Research Projects Agency (DARPA), Contract # FA8100-19-P-0022, March 2021.
- [2] *Semi-Autonomous Victim Extraction Robot (SAVER) Design*, US Army Medical Research and Materials Command (USAMRMC/TATRC), Contract # W81XWH-16-C-0062, Sep 2018.
- [3] *Symbiosis of Locomotion and Manipulation with Hybrid Mechanisms Mobile Robot*, Defense Advanced Research Projects Agency (DARPA), Contract # HR0011-11-1-0012, July 2013.
- [4] *Autonomous Symbiosis of Mobile Robotic Locomotion and Manipulation*, Defense Advanced Research Projects Agency (DARPA), Contract # HR0011-11-1-0012, July 2012.
- [5] *Field Experimental Results of a Hybrid Mechanism Mobile Robot*, Defense Advanced Research Projects Agency (DARPA), Contract # HR0011-09-1-0049, March 2011.
- [6] *Study on Autonomous Coupling of Navigation & Locomotion for a Hybrid Mechanism Mobile Robot*, Defense Advanced Research Projects Agency (DARPA), Contract HR0011-09-1-0049, Feb 2010.
- [7] *A Dispensing System for Microdrops Generation for Genomics and Proteomics Applications*, prepared for Materials & Manufacturing Ontario (MMO) Collaborative Project with Engineering Services Inc. (ESI), MMO Final Technical Report, July 2004.
- [8] *Survey on Droplet Generators – Assessment of Technologies and Applications*, MMO Technical Report, Toronto, Canada, September 2002.

## Sponsored Research Funding

**Total Extramural funding: \$4,225,471**

**Personal Share: \$2,445,286**

| Project title                                                                                                                                  | Sponsor                                                           | PI                                   | Funding Amount                             | Project Duration  | Status   |
|------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|--------------------------------------|--------------------------------------------|-------------------|----------|
| Robotic Hand Orthosis Providing Grasp Assistance for Patients with Brachial Plexus Injuries                                                    | <b>NIH – National Institutes of Health</b><br>Award # R21HD095027 | Ben-Tzvi, P.,<br>Bravo, C<br>(co-PI) | <b>\$393,823</b>                           | 5/6/19 – 04/30/21 | Complete |
| Closing the Loop between Robust Control of Agile Legged Robots and Bioinspired Robotic Tails: A Hybrid Systems Approach for Intrinsic Coupling | <b>NSF – National Science Foundation</b><br>Award # 1906727       | Ben-Tzvi, P., Akbari<br>(Co-PI)      | <b>\$396,036</b><br>(my portion \$244,366) | 5/10/19- 05/31/22 | Complete |

|                                                                                                                                                                    |                                                                                                                               |                                                        |                                            |                    |                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|--------------------------------------------|--------------------|--------------------|
| Collaborative Modular Robot Teammates for Shipboard Inspection and Maintenance                                                                                     | <b>ONR</b> – Office of Naval Research (DOD - Navy - SECNAV)<br>Award # N00014-19-1-2026                                       | Ben-Tzvi, P., Furukawa, T (PI for UVA)                 | <b>\$416,924</b><br>(my portion \$58,497)  | 1/01/20 – 12/31/21 | Complete           |
| <b>Phase I:</b> Self-driving Modular AI-based Robot for Rough Terrain (SMARTT)                                                                                     | <b>DARPA</b> – Defense Advanced Research Projects Agency (Through Intelligent Automation Inc.)<br>Contract # FA8100-19-P-0022 | Ben-Tzvi, P. (VT), Charifa, S. (IAI)                   | <b>\$225,000</b><br>(my portion \$90,000)  | 4/1/20-3/31/21     | Complete           |
| Phase II SBIR: Design of a Mobile Robot for LIFELINE-equipped Squad – Multipurpose Equipment Transport UGV                                                         | <b>U.S. Army</b> Medical Research and Material Command -Through RE2, Inc. Phase II SBIR<br>Award # W81XWH-16-C-0062           | Ben-Tzvi, P.                                           | <b>\$200,028</b>                           | 10/2016 - 09/2018  | Complete           |
| MRI: Development of a System for High-Resolution Uninterrupted Capture of Complex Animal Motions                                                                   | <b>NSF</b> – National Science Foundation                                                                                      | R. Muller, Ben-Tzvi (Senior Personnel)<br>+8 other SP  | <b>\$265,666</b><br>(my portion \$25,000)  | 10/2018-9/2020     | Active/<br>Ongoing |
| Trawl-Resistant Self-Mooring Autonomous Underwater Vehicle (AUV)                                                                                                   | <b>NAVO</b> – US Naval Oceanographic Office                                                                                   | Ben-Tzvi, P. (Co-PI), Stilwell, D. (PI)                | <b>\$379,057</b><br>(my portion \$71,373)  | 05/2017-05/2018    | Complete           |
| Active Dynamic Continuum Tails for Maneuvering and Stabilizing Legged Robots                                                                                       | <b>NSF</b> – National Science Foundation<br>Award #1334227/1557312                                                            | Ben-Tzvi, P.                                           | <b>\$307,672</b>                           | 09/2013-08/2017    | Complete           |
| IRES: US-China Collaboration: Bats as Model Organisms for Bioinspired Engineering                                                                                  | <b>NSF</b> – National Science Foundation                                                                                      | R. Muller, Ben-Tzvi (Senior Personnel)<br>+11 other SP | <b>\$250,000</b><br>(my portion \$20,000)  | 02/2017-01/2020    | Active/<br>Ongoing |
| Analysis of Ship Air Wakes with UAVs                                                                                                                               | <b>ONR</b> – Office of Naval Research<br>Grant # N00014-15-1-2043                                                             | Ben-Tzvi, P. (Co-PI), Snyder, M.R (PI)                 | <b>\$655,000</b><br>(my portion \$356,759) | 01/2015-01/2018    | Complete           |
| Development of Two-Finger Haptic Glove Exoskeleton for Delivery of Somatosensory Stimuli for Measurement of Cortical Responses in Neurologically Impaired Children | <b>NCH</b> - Nationwide Children's Hospital Research Institute, Through National Institutes of Health (NIH)                   | Ben-Tzvi, P.                                           | <b>\$50,028</b>                            | 02/2016 - 10/2016  | Complete           |

|                                                                                                                         |                                                                                     |              |                  |                 |          |
|-------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------|------------------|-----------------|----------|
| A Mechatronics Measurement System and Data Processing for Ship Air Wake Studies with UAVs                               | <b>USN</b> – United States Navy<br>Grant # N00189-12-P-1183                         | Ben-Tzvi, P. | <b>\$244,030</b> | 08/2012-02/2015 | Complete |
| Autonomous Symbiosis of Robotic Locomotion & Manipulation                                                               | <b>DARPA</b> –Defense Advanced Research Projects Agency<br>Grant #HR0011-11-1-0012  | Ben-Tzvi, P. | <b>\$100,000</b> | 09/2011-04/2013 | Complete |
| Study on Autonomous Coupling of Navigation and Locomotion for a Hybrid Mechanism Mobile Robot                           | <b>DARPA</b> – Defense Advanced Research Projects Agency<br>Grant #HR0011-09-1-0049 | Ben-Tzvi, P. | <b>\$299,707</b> | 07/2009-12/2010 | Complete |
| Kinetic Universal Robotic Assistive Joint                                                                               | <b>GWIBE</b> – GW Institute for Biomedical Eng.                                     | Ben-Tzvi, P. | <b>\$10,000</b>  | 11/2010-07/2011 | Complete |
| A Precise Piezoceramic Actuated Dispensing Array for Microdrops Generation and a Vision Based Testing Setup             | UFF/Dilthey Award – GWU Facilitating Fund                                           | Ben-Tzvi, P. | <b>\$20,000</b>  | 07/2009-08/2010 | Complete |
| Application of Electroactive Polymer (EAP) Artificial Muscles for Development of Bioinspired Walking Micro-Mobile Robot | <b>COBRE</b> – GW Center for Biomimetics and Bioinspired Engineering                | Ben-Tzvi, P. | <b>\$12,500</b>  | 01/2009-12/2009 | Complete |

## Other Awards and Recognitions

### Awards of graduate students whose research I am directing

#### Torgersen Graduate Research Excellence Award, Finalist

May 2022

Prof. Ben-Tzvi's doctoral student, Mr. Yujiong Liu, was selected for an oral and poster presentation category of the Torgersen Graduate Research Award for the research entitled "Novel Legged Robots with a Serpentine Robotic Tail: Modeling, Control, and Implementations". He was one among the 3 selected from all PhD applicants in the College of Engineering.

#### Torgersen Graduate Research Excellence Award, Poster

May 2019

Prof. Ben-Tzvi's doctoral student, Mr. Bijo Sebastian, was selected for the poster presentation category of the Torgersen Graduate Research Award for the research entitled "Traversability Estimation Techniques for Improved Navigation of Tracked Robots". He was one among the 8 selected from 59 PhD applicants in the College of Engineering.

#### GW Research Day, 1<sup>st</sup> place

April 2014

Prof. Ben-Tzvi's doctoral student, Mr. Will Rone, won 1<sup>st</sup> place for the research entitled "Biomimetic Robotic Tails for Agile Maneuvering of Field Mobile Robots"

Article published by *GW Today* in Summer 2014 issue pg. 11 is available here: <http://bit.ly/1e87Gui>

#### ASME Graduate Mechanism & Robot Design Competition, 2<sup>nd</sup> place

August 2012

Prof. Ben-Tzvi's doctoral student, Mr. Paul Moubarak, presented his research project titled "A Tri-state Rigid Reversible and Non-Back-Drivable Docking Mechanism for Modular Robotics Applications" at the ASME IDETC/CIE 2012, August 12-15, Chicago, IL and won 2<sup>nd</sup> place

**SEAS/GWU R&D Showcase, 3<sup>rd</sup> place**

February 2012

for the research entitled "STORM: Self-configurable and Transformable Omni-directional Robotic Modules", Article available here: <http://bit.ly/yVNEXh> (with Doctoral Student Paul Moubarak)

**Mechanism & Robot Design Competition, 3<sup>rd</sup> place**

August 2011

Students from my graduate robotics course presented their class project entitled "RAIL – Robotic Arm for Interactive Learning", at the ASME IDETC/CIE 2011, August 28-31, Washington, DC and won 3<sup>rd</sup> place  
<https://sites.google.com/site/asmesmrdc/past-winners>

## Recognitions & Media Coverage

**Media Coverage, Featured Article in *Virginia Tech News Daily***

January 2023

Article titled "Pinhas Ben-Tzvi, a professor and researcher in mechanical engineering, is partnering with physician Cesar Bravo of Carilion Clinic to develop a new tool for those who have suffered a brachial plexus injury", January 12, 2023 Issue.  
Article available at: <https://tinyurl.com/52x5pmur>

**Media Coverage, Featured Video in *Virginia Tech ME LinkedIn***

December 2022

Article titled "Pinhas Ben-Tzvi teamed up with Carilion Clinic to create a robotic hand for use by those with brachial plexus injuries", December 7, 2022.  
Article available at: <https://tinyurl.com/2p9fcpwn>

**Media Coverage, Featured Article in *Virginia Tech News Daily***

September 2022

Article titled "Inventor Spotlight: Pinhas Ben-Tzvi, professor of mechanical engineering", September 27, 2022 Issue.  
Article available at: <https://www.vt.edu/link/license/faculty-inventors/pinhas-ben-tzvi.html>

**Media Coverage, Cover Article Featured in *VT/ME Momentum Magazine***

July 2022

Article titled "Pinhas Ben-Tzvi named Fellow of the ASME", Vol. 7, Issue 1, pp. 15, Spring 2022. Article available at: <https://bit.ly/3zFTjdh>

**Media Coverage, Featured Article in *Virginia Tech News Daily***

March 2022

Article titled "Pinhas Ben-Tzvi named fellow of the American Society of Mechanical Engineers", March 15, 2022 Issue.  
Article available at: <https://tinyurl.com/mu8zpv5j>

**Media Coverage, Article Featured in *VT/ME Annual Report***

Dec. 2021

Article titled "Robots with Tails"  
December 2021 Issue. Article available at: <https://bit.ly/3Dw1I30>

**Media Coverage, Article Featured in *Mechanical Engineering Magazine***

Oct. 2021

Article titled "Robots with Tails", Vol. 143, Issue 6, pp. 32-37, October/November 2021.  
Article available at: <https://www.asme.org/topics-resources/content/engineers-could-put-tails-on-robots>

**Media Coverage, Cover Article Featured in *VT/ME Annual Report***

Dec. 2018

Article titled "Robotic Tails: High-Tech Tails May Provide Bio-Inspired Solution to Robot Stability", December 2018 Issue. Article available at: <https://vtechworks.lib.vt.edu/handle/10919/81207>

- Media Coverage**, Cover Article Featured in *VT/ME Momentum Magazine* June 2018  
Article titled "Tails: The evolution of robots? Robotic tails facilitate robot movement",  
Vol. 3, Issue 2, pp. 10-15, Summer 2018. Article available at: <https://joom.ag/c9jY>
- Media Coverage**, Article Featured in *Roanoke Times* May 2018  
Article titled "Virginia Tech animal-inspired robot tails",  
May 14, 2018 issue. Article available at: <https://bit.ly/2Gdi6rq>
- Media Coverage**, Article Featured in *VT/ME Momentum Magazine* June 2017  
Article titled "UG lab gets students engaged in robotics",  
Vol. 2, Issue 2, pp. 23, Summer 2017. Article available at: <https://joom.ag/1sBW>
- Media Coverage**, Featured Article in *Virginia Tech News Daily* April 2017  
Article titled "New robotics teaching lab enhances engineers' skills", April 10, 2017 Issue.  
Article available at: <https://vtnews.vt.edu/articles/2017/04/me-roboticsteachinglab.html>
- Media Coverage**, Featured Video and Article in *WDBJ-7 CBS-Affiliated TV Station* June 2016  
Article titled "Exoskeleton glove developed at Virginia Tech could diagnose cerebral  
palsy in children", June 17, 2016.  
Video/Article available at: <http://www.wdbj7.com/content/news/love-modified-to--383468791.html>
- Media Coverage**, Featured Article in *Cerebral Palsy News Today* June 2016  
Article titled "Cerebral Palsy Might Be Detected in Toddlers with Glove  
by Exoskeleton Engineer", June 22, 2016 Issue.  
Article available at: <http://bit.ly/2kOU0Mi>
- Media Coverage**, Featured Article in *3D Printer and 3D Printing News* June 2016  
Article titled "VT engineer 3D prints robotic exoskeleton glove to help cerebral  
palsy diagnosis in children", June 23, 2016 Issue.  
Article available at: <http://bit.ly/28RVu3H>
- Media Coverage**, Featured Article in *Global News Connect* June 2016  
Article titled "Engineer Modifies Robotic Exoskeleton Glove to Assistance  
Intelligent Palsy Diagnosis in Children", June 13, 2016 Issue.  
Article available at: <http://bit.ly/2fDTxf1>
- Media Coverage**, Featured Article in *ASEE\* First Bell Magazine* June 2016  
Article titled "Virginia Tech Engineer Develops Robotic Exoskeleton  
Hand to Diagnose Children", June 21, 2016 Issue.  
Article: <http://mailview.bulletinmedia.com/mailview.aspx?m=2016062101asee&r=2892555-5e40>  
\* ASEE – American Society of Engineering Education
- Media Coverage**, Article Featured in *VT/ME Momentum Magazine* July 2016  
Article titled "Exoskeleton to help cerebral palsy diagnosis in children",  
Vol. 1, Issue 2, pp. 12, July 2016. Article available at: <http://bit.ly/2aytqSW>
- Media Coverage**, Featured Article in *Virginia Tech News Daily* June 2016  
Article titled "Engineer modifies robotic exoskeleton glove to help cerebral palsy  
diagnosis in children", June 10, 2016 Issue.  
Article available at: <https://vtnews.vt.edu/articles/2016/06/me-roboticdiagnosticglove.html>
- Recognition**, Robotics and Mechatronics Laboratory (RML) December 2013  
Cited on the newly published list of 99 Superb Sites on Mechatronics & Robotics Engineering,  
<http://www.electricalengineeringschools.org/mechatronics>

|                                                                                                                                                                                                                                                                                                                                                                                                                    |               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>Media Coverage</b> , Featured Article in <b>GW Alumni Magazine</b><br>Article titled "The Body Robotics", Summer 2013 Issue, pp. 56-59.<br>Article available at: <a href="http://magazine.gwu.edu/body-robotic">http://magazine.gwu.edu/body-robotic</a>                                                                                                                                                        | June 2013     |
| <b>Media Coverage</b> , Featured Article in <b>GW Research Magazine</b><br>Article titled "The Body Robotics: Form, function, and the future as seen through the eyes and handiwork of three GW roboticists", Spring 2013 Issue, pp. 19-23.<br>Article available at: <a href="http://www.gwu.edu/~magazine/2013_research_spring/feature1.html">http://www.gwu.edu/~magazine/2013_research_spring/feature1.html</a> | April 2013    |
| <b>Media Coverage</b> , television interview to <b>CTV News (Canadian Television Network)</b><br>Live interview on <a href="#">The Advancement of Robots</a><br>Interview available at: <a href="http://bit.ly/1yU7DX2">http://bit.ly/1yU7DX2</a>                                                                                                                                                                  | Nov. 2012     |
| <b>Media Coverage</b> , blog posting on the <b>Scientific American</b><br>Article titled "School Turns Engineering Faculty into Superheroes"<br>Article available at: <a href="http://bit.ly/KzAADF">http://bit.ly/KzAADF</a>                                                                                                                                                                                      | May 2012      |
| <b>Media Coverage</b> , GW's Newspaper published by <b>GW Today</b><br>Article titled "Engineering Interest - New SEAS marketing campaign uses superheroes to highlight ground-breaking research"<br>Article available at: <a href="http://bit.ly/KrooQr">http://bit.ly/KrooQr</a>                                                                                                                                 | April 2012    |
| <b>Newspaper Article</b> , published by <b>The GW Hatchet</b><br>"SEAS shows off 'superhero' engineers", Vol. 108, Issue 56, pp. 3, Apr 16, 2012<br>Featured article on my research on modular and reconfigurable mobile robotics<br>Article available at: <a href="http://bit.ly/HLUGJB">http://bit.ly/HLUGJB</a>                                                                                                 | April 2012    |
| <b>Media Coverage</b> , published by <b>SEAS/GWU</b><br>SEAS features Prof. Ben-Tzvi as a "superhero" – RobotronMan<br>Article available at: <a href="http://bit.ly/1AfmE89">http://bit.ly/1AfmE89</a>                                                                                                                                                                                                             | April 2012    |
| <b>Media Coverage</b> , Featured Article by <b>The GW Hatchet</b><br>Robotics Workshop for GW's Science, Technology and Engineering Day<br>Article available at: <a href="http://bit.ly/HHnTmz">http://bit.ly/HHnTmz</a>                                                                                                                                                                                           | April 2012    |
| <b>Media Coverage</b> , GW's Newspaper published by <b>GW Today</b><br>For winning 3 <sup>rd</sup> place in the GWU SEAS R&D Showcase<br>Article available at: <a href="http://bit.ly/yVNEXh">http://bit.ly/yVNEXh</a>                                                                                                                                                                                             | March 2012    |
| <b>Media Coverage</b> , radio interview to <b>China Radio International</b><br>Live, hour-long panel discussion on <a href="#">Robot Revolution</a><br>Interview available at: <a href="http://english.cri.cn/8706/2011/12/09/2861s670868.htm">http://english.cri.cn/8706/2011/12/09/2861s670868.htm</a>                                                                                                           | December 2011 |
| <b>Media Coverage</b> , Television interview for <b>Voice of America</b><br>Covered ongoing research activities in the Robotics and Mechatronics Lab<br>Video and article available at: <a href="http://bit.ly/uHXKPz">http://bit.ly/uHXKPz</a>                                                                                                                                                                    | August 2011   |
| <b>Media Coverage</b> , Featured Video and Article at <b>Loudoun Times</b><br>Robotics Workshop for GW's Science, Technology and Engineering Day<br>Article and video available at: <a href="http://bit.ly/e94yNk">http://bit.ly/e94yNk</a>                                                                                                                                                                        | April 2011    |
| <b>Media Coverage</b> , Featured Article at <b>Leesburg Today</b><br>Robotics Workshop for Loudon county high school students as part of GW's Science, Technology and Engineering Day at the Virginia Science and Technology Campus                                                                                                                                                                                | April 2011    |

Article available at: <http://bit.ly/odlyXJ>

**Media Coverage**, radio interview on the show *Today on Beyond Beijing*  
Panel discussion featuring international experts on the future of robotics  
Interview available at: <http://english.cri.cn/8706/2011/01/07/481s613923.htm>

January 2011

**Featured** in GW's Newspaper published by **GW Today**  
Article titled "[The Robot Revolution](#)"  
Article available at: <http://gwtoday.gwu.edu/robot-revolution>

August 2010

**Featured** in 2010 issue of SEAS **Synergy Magazine** (pg. 6) showcasing my  
research activities at the GW Robotics and Mechatronics Lab

July 2010

**Featured** in the [SEAS Video](#) highlighting my research in the  
*Robotics & Mechatronics Lab in SEAS*  
[http://www.rmlab.org/bentzvi\\_GW\\_video.php](http://www.rmlab.org/bentzvi_GW_video.php)

May 2010

\* Video used as a media content for various audiences including graduate and undergraduate  
recruiting, raising funds for SEAS from prospective donors and keeping alumni engaged

**Featured photos** of the Robotics and Mechatronics Lab  
*SEC (Science and Engineering Hall) Brochure* highlighting students'  
research work in robotics and mechatronics

April 2010

---

## Student Supervision

---

### Graduated Ph.D. Students (10)

| Dates                    | Degree | Candidate          | Dissertation Title                                                                                                                    | Current Position                                                       |
|--------------------------|--------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| Aug. 2017 –<br>May 2022  | Ph.D.  | Yujiong Liu        | Novel Legged Robots with a<br>Serpentine Robotic Tail: Modeling,<br>Control, and Implementations                                      | Robotic System<br>Engineer, Cornerstone<br>medical USA Inc.            |
| May 2017 –<br>Dec. 2021  | Ph.D.  | Shumin<br>Feng     | Design, Analysis, Planning, and<br>Control of a Novel Modular Self-<br>Reconfigurable Robotic System                                  | Staff Robotics<br>Engineer, DIMAAG-AI                                  |
| Jan. 2018 –<br>Dec. 2020 | Ph.D.  | Taylor Njaka       | Design, Simulation, and<br>Experimental Validation of a Novel<br>High-Speed Omnidirectional<br>Underwater Propulsion Mechanism        | Postdoctoral<br>Researcher at Virginia<br>Tech                         |
| Sep. 2016 –<br>Mar. 2020 | Ph.D.  | Hailin Ren         | Human-Robot Interaction with Pose<br>Estimation and Dual-Arm<br>Manipulation Using Artificial<br>Intelligence                         | Senior Software<br>Engineer, MathWorks                                 |
| Jan. 2016 –<br>Sep. 2019 | Ph.D.  | Bijo<br>Sebastian  | Traversability Estimation Techniques<br>for Improved Navigation of Tracked<br>Mobile Robots                                           | Assistant Professor,<br>Indian Institute of<br>Technology, Madras      |
| Sep. 2012 –<br>Mar. 2018 | Ph.D.  | Wael Saab          | Design and Implementation of<br>Articulated Robotic Tails to Augment<br>the Performance of Reduced<br>Degree-of-Freedom Legged Robots | Senior Research and<br>Development<br>Engineer,<br>SoftWear Automation |
| Jan. 2012 –<br>Feb. 2018 | Ph.D.  | Anil Kumar         | Estimation and Mapping of Ship<br>Airwake Using RC Helicopters as a<br>Sensing Platform                                               | Senior Systems<br>Integration Engineer,<br>GM Cruise                   |
| Sep. 2010 –<br>Dec. 2017 | Ph.D.  | William S.<br>Rone | Hyperredundant Dynamic Robotic<br>Tails for Stabilizing and Maneuvering<br>Control of Legged Robots                                   | Mechanical Engineer,<br>US Airforce Nuclear<br>Weapons Center          |

|                       |       |                  |                                                                                            |                                                          |
|-----------------------|-------|------------------|--------------------------------------------------------------------------------------------|----------------------------------------------------------|
| Sep. 2009 – May 2013  | Ph.D. | Paul M. Moubarak | A Mobile Robot with Modular and Reconfigurable Mobility and Manipulation                   | Research Engineer, Ford Motor Company                    |
| Jan. 2010 – Dec. 2014 | Ph.D. | Zhou Ma          | Sensing and Force-Feedback Exoskeleton (SAFE) Robotic Glove Mechanism and Its Applications | Senior Robotics Engineer, US Medical Innovations Company |

### **Graduated M.S. Students (20)**

| <b>Dates</b>               | <b>Degree</b> | <b>Candidate</b>         | <b>Thesis Title</b>                                                                                                                 |
|----------------------------|---------------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Aug. 2020 – May 2022 (VT)  | M.S.          | Isaac Pressgrove         | A Systematic Design Methodology for Articulated Serpentine Robotic Tails to Assist Agile Robot Behaviors                            |
| Aug. 2019 – July 2021 (VT) | M.S.          | Sarthak Pradhan          | Design and Control of an Exoskeleton Glove Using a Neural Network Based Controller for Grasping Objects                             |
| Aug. 2019 – Dec. 2020 (VT) | M.S.          | Yunfei Guo               | Personalized Voice Activated Grasping System for a Robotic Exoskeleton Glove                                                        |
| Jan. 2019 – May 2020 (VT)  | M.S.          | Xiaoxue Han              | Autonomous Cricothyroid Membrane Detection and Manipulation using Neural Networks and a Robotic Arm for First-Aid Airway Management |
| Aug. 2017 – July 2019 (VT) | M.S.          | Teja Vanteddu            | Grasp Stability with a Robotic Exoskeleton Glove                                                                                    |
| Aug. 2017 – May 2019 (VT)  | M.S.          | Shubhdildeep Singh Sohal | A Hybrid Tracking Approach for Autonomous Docking in Self-Reconfigurable Robotic Modules                                            |
| Aug. 2017 – Dec. 2018 (VT) | M.S.          | Jiteng Yang              | A Two-DOF Bipedal Robot Utilizing the Reuleaux Triangle Drive Mechanism                                                             |
| May 2017 – Dec. 2018 (VT)  | M.S.          | Shumin Feng              | Mobile Robot Obstacle Avoidance Based on Deep Reinforcement Learning                                                                |
| Sep. 2016 – May 2018 (VT)  | M.S.          | Adam Williams            | A Robotic Head Stabilization Device for Post-Trauma Transport                                                                       |
| Sep. 2016 – May 2018 (VT)  | M.S.          | Brielle Junghee Lee      | Development of Intelligent Exoskeleton Grasping Through Sensor Fusion and Slip Detection                                            |
| Jan. 2016 – Dec. 2017 (VT) | M.S.          | Vinaykarthik Kamidi      | Design and Integration of Novel Single Degree of Freedom Leg For Fast Locomotion                                                    |
| Jan. 2016 – Dec. 2017 (VT) | M.S.          | Peter Racioppo           | Design and Control of a Modular, Cable-Driven Snake Robot                                                                           |
| Jan. 2016 – Dec. 2017 (VT) | M.S. (ECE)    | Eric Refour              | Design and Integration of a Form-Fitting General Purpose Robotic Hand Exoskeleton                                                   |
| Sep. 2012 –                | M.S.          | Jeffrey Phillips         | Exoskeleton robotic arms for rehabilitation                                                                                         |

|                            |      |                 |                                                            |
|----------------------------|------|-----------------|------------------------------------------------------------|
| May 2014 (GW)              |      |                 | applications                                               |
| Sep. 2012 – May 2014 (GW)  | M.S. | Bohua Zhang     | Robotic wrist exoskeleton device for debilitated patients  |
| Sep. 2012 – May 2014 (GW)  | M.S. | Yue Sun         | Modeling and simulation of micro-droplet precision devices |
| Sep. 2010 – May 2012 (GW)  | M.S. | Chad Gilman     | Medical robotics – human wrist joint assist robot          |
| Sep. 2013 – Aug. 2015 (GW) | M.S. | Xiaofan Liu     | Non-Thesis                                                 |
| Sep. 2013 – Aug. 2015 (GW) | M.S. | Teng Long       | Non-Thesis                                                 |
| Sep. 2012 – May 2015 (GW)  | M.S. | Olugbenga Idowu | Non-Thesis                                                 |

#### **Current PhD and MS Students**

| Dates                         | Degree | Candidate                                      | Research Topic                                                                                                        |
|-------------------------------|--------|------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Dec. 2020 – Present (VT) (VT) | Ph.D.  | Yunfei Guo (ECE)                               | Voice activation Control of Robotic Exoskeleton Gloves                                                                |
| Aug. 2019 – Present (VT)      | Ph.D.  | Wenda Xu                                       | Machine Learning Algorithms for Autonomous Grasping with a Reduced-DOF Exoskeleton Glove for Brachial Plexus Injuries |
| Aug. 2020 – Present (VT)      | Ph.D.  | Jingyuan Qi (CS)<br>Co-advised with Prof. Feng | Machine learning application in human robot interaction and UAV                                                       |

#### **Visiting PhD Students**

| Date                    | Candidate   | Originating Institution                      | Topic                                                                                        |
|-------------------------|-------------|----------------------------------------------|----------------------------------------------------------------------------------------------|
| 09/01/2019 – 10/31/2020 | Xiaoyun Lei | Nanjing University of Science and Technology | Dual-arm Cooperation Manipulation with Distance Constrains using Deep Reinforcement Learning |

#### **Postdoctoral Scientists**

| Employed             | Student           | Degree and Institution                     | Research Topic                                                                | Employment                                 |
|----------------------|-------------------|--------------------------------------------|-------------------------------------------------------------------------------|--------------------------------------------|
| May 2014– Apr. 2017  | Dr. Lawrence Wong | Ph.D., University of Waterloo              | Micromachined Ultrasonic Transducers for Non-destructive Testing Applications | Advanced Research Engineer at Thalmic Labs |
| Jan. 2012– Jan. 2013 | Dr. Radu Robotin  | Ph.D., Technical University of Cluj-Napoca | Vision Guided Autonomous Robotic Locomotion and                               | Cloud Systems Engineer at National Cancer  |

|                        |                      |                                                                    |                                                                                         |                                                             |
|------------------------|----------------------|--------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-------------------------------------------------------------|
|                        |                      |                                                                    | Manipulation                                                                            | Institute (NCI)                                             |
| Feb 2010–<br>Feb. 2011 | Dr.<br>Xianxin<br>Ke | Ph.D., Shanghai<br>University                                      | Dynamic Mobility of an<br>Omni-wheel Robots                                             | Associate<br>Professor at<br>Shanghai Univ.                 |
| Nov 2009–<br>Jan. 2011 | Dr. Samer<br>Charifa | Ph.D., North Carolina<br>Agricultural and<br>Technical State Univ. | Volumetric<br>Environment Mapping<br>Using Multi-sensor<br>Fusion for Robotic<br>Vision | Research<br>Scientist at<br>Intelligent<br>Automation, Inc. |

### **Visiting Professors**

| Date                     | Candidate              | Originating<br>Institution        | Topic                                                        |
|--------------------------|------------------------|-----------------------------------|--------------------------------------------------------------|
| Sep. 2010 –<br>Sep. 2012 | Prof. Jae Weon<br>Choi | Pusan National<br>Univ., S. Korea | Navigation, Guidance, and Control for<br>Autonomous Vehicles |

### **Visiting Scholars Advising**

| Date                     | Candidate                | Topic                                                                                                                              |
|--------------------------|--------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Jul. 2010 –<br>Sep 2011  | Prof. Arif Ankarali      | ANFIS* Inverse Kinematics and Precise Trajectory Tracking of a<br>Dual Arm Robot (* <i>Adaptive Neuro Fuzzy Inference System</i> ) |
| Oct. 2009 –<br>Jan. 2010 | Dr. Getachew<br>Befekadu | Decentralized control and optimization of interconnected systems<br>with applications to multiple robots coordination              |

### **Undergraduate Students Research Thesis/Projects Advising**

| Date                     | Candidate        | Department  | Research Topic                                                                      |
|--------------------------|------------------|-------------|-------------------------------------------------------------------------------------|
| Aug. 2022 –<br>Present   | Renrui Liu       | ME/VT       | Exoskeleton Robotic Glove Design for Hand<br>Rehabilitation                         |
| May 2020 –<br>Present    | Alex Broz        | ME/VT       | Design of a two-section robotic tail based on<br>the Rigitail                       |
| May 2020 –<br>Present    | Ruichang Chen    | ECE/VT      | Simulation environment development of<br>modular and reconfigurable robots in V-Rep |
| Aug. 2019 –<br>Dec 2020  | Logan Stevenson  | ME/VT       | Upper extremity exoskeletons for robot control<br>and rehabilitation therapy        |
| Feb. 2019 –<br>Dec 2020  | Jonah Fike       | AOE/VT      | Omni-Direction Propulsion Mechanism for<br>Underwater Vehicles                      |
| May 2019 –<br>Dec 2020   | Marco Brizzolara | Physics /VT | Omni-Direction Propulsion Mechanism for<br>Underwater Vehicles                      |
| May 2019 –<br>Dec 2020   | Abdalla Diraz    | ME/VT       | Robotic Exoskeleton Glove Mechanism for<br>Autonomous Grasping                      |
| Jan. 2019 –<br>Dec 2020  | Jingyuan Qi      | Physics/VT  | Machine learning application in human robot<br>interaction and UAV                  |
| Sep. 2018 –<br>Dec 2020  | Samatar Jama     | ME/VT       | Semi-autonomous Robot Motion Planning                                               |
| Sep. 2018 –<br>Dec. 2018 | Alex Rhee        | ECE/VT      | Design of Rotary SEA for Robotic Glove<br>Exoskeleton Applications                  |
| May 2018 –               | Alina Voelker    | ME/VT       | Vision Based Localization Techniques for                                            |

|                       |                               |         |                                                                                       |
|-----------------------|-------------------------------|---------|---------------------------------------------------------------------------------------|
| Dec. 2018             |                               |         | Ground Robots                                                                         |
| Jan 2018 – May 2019   | Kefan Li                      | ME/VT   | Autonomous Grasping with a Robotic Exoskeleton                                        |
| Nov 2017 – May 2018   | Zhoubao Pang                  | ME/VT   | Design and Integration of a Single-DOF Biped with a Rigid Robotic Tail                |
| Nov 2017 – May 2018   | Hongxu (Howard) Guo           | ME/VT   | Controller Design for a Single-DOF Biped Locomotion with a Robotic Tail               |
| Jan 2017 – Dec. 2018  | Nicole Gouhin                 | ME/VT   | Review of Bio-inspired Robotic Tails                                                  |
| Jan 2017 – Dec. 2018  | Xinran Wang                   | ME/VT   | Suspension Design for a Search and Rescue Mobile Ground Robot                         |
| May 2017 – Aug 2017   | Youssef Haridy                | ME/VT   | Docking Mechanisms for Modular Robotic Modules                                        |
| Jan 2016 – May 2017   | David Evans                   | CEC/VT  | Design of Embedded Controllers for Reconfigurable Robotic Modules                     |
| Jan 2016 – May 2017   | Brock Davis                   | ME/VT   | Modeling and Controls of a Robotic Exoskeleton Mechanism for Rehabilitation           |
| Jan 2016 – Dec 2016   | Tommy Hutcheson               | ME/VT   | Design and Simulation of a 2-finger Robotic Exoskeleton Mechanism for Rehabilitation  |
| Jan 2015 – Aug 2015   | Timothy Wetzel                | MAE/GWU | Simulation of Robotic Tails for Maneuvering Quadruped Robots                          |
| May 2013 – Aug 2015   | Cyndi-Leigh Pine              | MAE/GWU | Rehabilitation robotics and computer-aided design                                     |
| Jan 2014 – May 2014   | Robert Forcha                 | MAE/GWU | Simulation of Fingers Position for Hand Rehabilitation Application                    |
| May 2011 – May 2013   | Eric Alvarez                  | MAE/GWU | Design of docking interface for reconfigurable mobile robotic system                  |
| Sep 2011 – May 2013   | Jeff Birenbaum                | MAE/GWU | Synergistic Piezo Actuation                                                           |
| Sep 2011 – Sep 2012   | Jeffrey Phillips              | MAE/GWU | Continuum Robotics for Rehabilitation                                                 |
| Jan – May 2012        | Allison Hogarth & David Perry | MAE/GWU | Moving Side View Mirror for Blind Spot Detection                                      |
| Sep 2011 – Dec 2011   | Jimmy Gomez                   | MAE/GWU | Robotic exoskeleton device for augmenting wrist movement in debilitated patients      |
| Sep. 2010 – Sep. 2012 | Danielle Barsky               | MAE/GWU | Modeling and Simulation of MEMS tilt sensor                                           |
| May 2011 – Sep 2011   | Gabriel Yessin                | ECE/GWU | Optimization of algorithms for remote control operation of a mobile robot             |
| Sep. 2009 – Jan. 2011 | Michael Shick                 | CS/GWU  | Algorithms for mobile robot autonomous functions                                      |
| May 2009 – Aug. 2010  | Will Rone                     | MAE/GWU | Piez-actuated dispensing system for micro-drops generation in microarray applications |
| May–Sep 2009          | Sarah Beaver                  | MAE/GWU | Electroactive polymers applied toward biomimetic robots                               |
| May–Dec 2009          | Tim Perkins                   | MAE/GWU | Smart materials for the development of biomimetic micro-robots                        |
| Dec. 2009 –           | Marcus                        | MAE/GWU | Mechanical and electrical design layout for a                                         |

|                        |                  |         |                                                               |
|------------------------|------------------|---------|---------------------------------------------------------------|
| June 2010              | Hendricks        |         | mobile robot remote controller                                |
| Mar. 2010 – April 2011 | Hannah Stuart    | MAE/GWU | Development of a operating control unit for a mobile robot    |
| Mar. 2010 – April 2011 | Micah Foster     | MAE/GWU | Development of a operating control unit for a mobile robot    |
| Mar. 2010 – Dec 2010   | Nicholas Blanton | MAE/GWU | Detailed design layout of a operating control unit components |
| June – Sep 2010        | Brandon Fix      | MAE/GWU | Perform design layouts of mechanical parts using SolidWorks   |

### **Undergraduate Interns Supervision**

| Date            | Candidate                   | Originating Institution                   | Topic                                                                                                                                                        |
|-----------------|-----------------------------|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Oct – Dec. 2010 | Gustavo Ruiz, B.Sc.         | Polytechnic University of Chiapas, Mexico | Hardware-in-the-loop (HIL) simulations of dual arm mobile robotic system ( <i>Funded by the Mexican government under the Governors' Internship Program</i> ) |
| Jan–Apr. 2010   | Mikhail Zhuk, MechE Senior  | University of California, Irvine          | Modeling and simulation of robotic systems using ADAMS and ATV ToolKit                                                                                       |
| Jun–Aug. 2010   | Ari Schifftan, MechE Junior | University of Miami, FL                   | Modeling and analysis of mechanical parts for a hybrid mobile robot using ABAQUS FEA SW                                                                      |

### **Ph.D. Dissertation External Examiner**

| Student Name | Thesis Title                                     | Defense date | Institution                                                   |
|--------------|--------------------------------------------------|--------------|---------------------------------------------------------------|
| So-Ra Chung  | MEMS Demodulator Based on Electrostatic Actuator | July 6, 2012 | University of Waterloo<br>Dept. of Systems Design Engineering |

### **PhD/MS Thesis Reader / Committee Member/Chair**

| Student Name    | Thesis/Dissertation Title                                                                                             | Level | Defense date  | Advisor               | Role / Institution         |
|-----------------|-----------------------------------------------------------------------------------------------------------------------|-------|---------------|-----------------------|----------------------------|
| Shumin Feng     | Design, Analysis, Planning, and Control of a Novel Modular Self-Reconfigurable Robotic System                         | Ph.D. | Dec. 2, 2021  | Dr. P. Ben-Tzvi       | Dissertation Director/ VT* |
| Michael Molzon  | Development of a Mobile Robot System for the Visual Inspection of Railcar Undercarriage Equipment                     | Ph.D. | June 2022     | Dr. Mehdi Ahmadian    | Committee Member/ VT*      |
| Sarthak Pradhan | Design and Control of an Exoskeleton Glove Using a Neural Network Based Controller for Grasping Objects               | M.S.  | July 23, 2021 | Dr. P. Ben-Tzvi       | Thesis Director/ VT*       |
| Yunfei Guo      | Personalized Voice Activated Grasping System for a Robotic Exoskeleton Glove                                          | M.S.  | Dec. 10, 2020 | Dr. P. Ben-Tzvi       | Thesis Director/ VT*       |
| Taylor Njaka    | Design, Simulation, and Experimental Validation of a Novel High-Speed Omnidirectional Underwater Propulsion Mechanism | Ph.D. | Dec. 14, 2020 | Dr. P. Ben-Tzvi       | Dissertation Director/ VT* |
| Grant Carter    | Adaptive Control of the Transition from Vertical to Horizontal Flight Regime of a Quad-Tailsitter UAV                 | M.S.  | May 12, 2021  | Dr. Andrea L'Afflitto | Committee Member/ VT*      |

|                    |                                                                                                                              |       |                |                      |                            |
|--------------------|------------------------------------------------------------------------------------------------------------------------------|-------|----------------|----------------------|----------------------------|
| Alfred Mayalu      | Beyond LiDAR for Unmanned Aerial Event-Based Localization in GPS Denied Environments                                         | Ph.D. | May 20, 2021   | Dr. K. Kochersberger | Committee Member/ VT*      |
| Kenneth E. Kroeger | Decentralized Task Allocation and Coordination of Heterogeneous UxVs Subjected to Spatiotemporally Evolving Environment      | Ph.D. | TBD            | Dr. K. Kochersberger | Committee Member/ VT*      |
| Wael Saab          | Design and Implementation of Articulated Robotic Tails to Augment the Performance of Reduced Degree-of-Freedom Legged Robots | Ph.D. | March 19, 2018 | Dr. P. Ben-Tzvi      | Dissertation Director/ VT* |
| Anil Kumar         | Estimation and Mapping of Ship Air Wakes using RC Helicopters as a Sensing Platform                                          | Ph.D. | Feb. 26, 2018  | Dr. P. Ben-Tzvi      | Dissertation Director/ VT* |
| William S. Rone    | Hyperredundant Dynamic Robotic Tails for Stabilizing and Maneuvering Control of Legged Robots                                | Ph.D. | Dec. 13, 2017  | Dr. P. Ben-Tzvi      | Dissertation Director/ VT* |
| Bijo Sebastian     | Traversability Estimation Techniques for Improved Navigation of Tracked Mobile Robots                                        | Ph.D. | Sep. 19, 2019  | Dr. P. Ben-Tzvi      | Dissertation Director/ VT* |
| Hailin Ren         | Human-Robot Interaction with Pose Estimation and Dual-Arm Manipulation Using Artificial Intelligence                         | Ph.D. | March 23, 2020 | Dr. P. Ben-Tzvi      | Dissertation Director/ VT* |
| Shumin Feng        | Path Planning Algorithms and Control of Modular Mobile Robots                                                                | Ph.D. | TBD            | Dr. P. Ben-Tzvi      | Dissertation Director/ VT* |
| Yujiong Liu        | Dynamics Modeling and Control of Hybrid Robotic Tail-Bipedal Systems                                                         | Ph.D. | TBD            | Dr. P. Ben-Tzvi      | Dissertation Director/ VT* |
| Negin Nikafrooz    | Design, fabrication, and control of an assistive glove for farmers with mobility limitations                                 | Ph.D. | Spring 2021    | Dr. A. Leonessa      | Committee Member/ VT*      |
| Murat Ambarkutuk   | Development of a Non-Line-of-Sight Perception Technique with high-frequency short range RADAR for Deformation Measurements   | Ph.D. | Fall 2020      | Dr. T. Furukawa      | Committee Member/ VT*      |
| Murtaza Rangwala   | Control and coordination of multi-agent systems/robots using deep reinforcement learning                                     | Ph.D. | TBD            | Dr. Ryan Williams    | Committee Member/ VT*      |
| Jiteng Yang        | A Two-DOF Bipedal Robot Utilizing the Reuleaux Triangle Drive Mechanism                                                      | M.S.  | Nov. 16, 2018  | Dr. P. Ben-Tzvi      | Thesis Director/ VT*       |
| Shumin Feng        | Mobile Robot Obstacle Avoidance Based on Deep Reinforcement Learning                                                         | M.S.  | Dec. 12, 2018  | Dr. P. Ben-Tzvi      | Thesis Director/ VT*       |
| Adam Williams      | A Robotic Head Stabilization Device for Post-Trauma Transport                                                                | M.S.  | May 9, 2018    | Dr. P. Ben-Tzvi      | Thesis Director/ VT*       |

|                          |                                                                                                                        |       |                |                      |                        |
|--------------------------|------------------------------------------------------------------------------------------------------------------------|-------|----------------|----------------------|------------------------|
| Brielle Junghee Lee      | Development of Intelligent Exoskeleton Grasping Through Sensor Fusion and Slip Detection                               | M.S.  | May 9, 2018    | Dr. P. Ben-Tzvi      | Thesis Director/ VT*   |
| Peter Racioppo           | Design and Integration of a Form-Fitting General Purpose Robotic Hand Exoskeleton                                      | M.S.  | Dec. 11, 2017  | Dr. P. Ben-Tzvi      | Thesis Director/ VT*   |
| Vinaykarthik Kamidi      | Design and Integration of Novel Single Degree of Freedom Leg For Fast Locomotion                                       | M.S.  | Dec. 19, 2017  | Dr. P. Ben-Tzvi      | Thesis Director / VT*  |
| Eric Refour              | Design and Integration of a Form-Fitting General Purpose Robotic Hand Exoskeleton                                      | M.S.  | Sep. 29, 2017  | Dr. P. Ben-Tzvi      | Thesis Director/ VT*   |
| Teja Vanteddu            | Grasp Stability with a Robotic Exoskeleton Glove                                                                       | M.S.  | July 24, 2019  | Dr. P. Ben-Tzvi      | Thesis Director/ VT*   |
| Shubhdildeep Singh Sohal | A Hybrid Tracking Approach for Autonomous Docking in Self-Reconfigurable Robotic Modules                               | M.S.  | May 9, 2019    | Dr. P. Ben-Tzvi      | Thesis Director/ VT*   |
| Gordon Christie          | Collaborative Unmanned Air and Ground Vehicle Perception for Scene Understanding, Planning and GPS-denied Localization | Ph.D. | Nov. 7, 2016   | Dr. K. Kochersberger | Committee Member/ VT*  |
| Hubert Kim               | Joint Torque Feedback for Motion Training with an Elbow Exoskeleton                                                    | Ph.D. | Sep. 14, 2021  | Dr. A. Asbeck        | Committee Member/ VT*  |
| Sebastien Corner         | Modeling, Sensitivity Analysis, and Optimization of Hybrid, Constrained Mechanical Systems                             | Ph.D. | Feb. 14, 2018  | Dr. Corina Sandu     | Committee Member/ VT*  |
| Adam Lowery              | Enhanced Portability and Anti-Frosting Functionality of Cryostats for Synchrotron-Based X-ray Imaging                  | Ph.D. | June 21, 2022  | Dr. Jonathan Boreyko | Committee Member/ VT*  |
| Cong Chen                | Robust Motion Tracking and Post Estimation of Combined Camera and Lidar 3D Shape                                       | Ph.D. | TBD            | Dr. T. Furukawa      | Committee Member/ VT*  |
| Mengyu Song              | Specular Micro-texture Photometry for Circumferential Three-Dimensional Profiling                                      | Ph.D. | May 19, 2020   | Dr. T. Furukawa      | Committee Member/ VT*  |
| John Seminatore          | Design of a Series Elastic Humanoid for the DARPA Robotics Challenge                                                   | M.S.  | August 3, 2016 | Dr. Al Wicks         | Committee Member / VT* |
| Tom Ehrenzeller          | Visual Servoing Using a Two Armed Robot                                                                                | M.S.  | TBD            | Dr. T. Furukawa      | Committee Member/ VT*  |
| Chen Tang                | Design of a Gravity Compensation Actuator for Arm Assistance                                                           | M.S.  | Dec. 18, 2017  | Dr. Alan Asbeck      | Committee Member/ VT*  |
| Yi Tian                  | Self-Powered Intelligent Traffic Monitoring Using IR Lidar and Camera                                                  | M.S.  | Dec. 8, 2016   | Dr. T. Furukawa      | Committee Member/ VT*  |
| Murat Ambarkutuk         | A Grid-based Radiolocation Technique Based on Spatially Coherent Path Loss Model                                       | M.S.  | Sep. 1, 2017   | Dr. T. Furukawa      | Committee Member/ VT*  |
| Bryan Todd               | Comparison of the Role of Beamwidth in Biological and Engineered Sonar                                                 | M.S.  | Sep. 29, 2017  | Dr. R. Mueller       | Committee Member/ VT*  |

|                      |                                                                                                          |       |                |                      |                              |
|----------------------|----------------------------------------------------------------------------------------------------------|-------|----------------|----------------------|------------------------------|
| Zhou Ma              | Sensing and Force-Feedback Exoskeleton Robotic (SAFER) Glove Mechanism for Rehabilitation                | Ph.D. | Dec. 15, 2014  | Dr. P. Ben-Tzvi      | Dissertation Director/ GWU** |
| Paul M. Moubarak     | A Mobile Robot with Modular and Reconfigurable Mobility and Manipulation                                 | Ph.D. | March 15, 2013 | Dr. P. Ben-Tzvi      | Dissertation Director/ GWU** |
| Robert Cortesi       | Modeling and Control of Joint-Actuated Buoys                                                             | Ph.D. | Feb. 15, 2012  | Dr. D. Chichka       | Committee Member/ GWU**      |
| Kenan Cole           | Design, Analysis, and Optimization of an Interferometer for Extreme Ultraviolet Interference Lithography | M.S.  | Nov. 10, 2010  | Dr. R. Ryan Vallance | Committee Member/ GWU**      |
| Jaime Alba-Bohorquez | Design of a Robust Altitude-Hold Controller for UAVs Using Neural Networks                               | M.S.  | Nov. 21, 2008  | Dr. D. Chichka       | Committee Member/ GWU**      |

\* VT – Virginia Tech; \*\* GWU – George Washington University

### High School Students Mentoring

| Date                 | Candidate           | School Name                | Topic                                                       |
|----------------------|---------------------|----------------------------|-------------------------------------------------------------|
| Summer 2022          | Phillipe Charalanis | Blacksburg Middle School   | Camera System for Human Motion Detection and Tracking       |
| May 2019 – Dec. 2020 | Kye Gonino          | James River High School    | Omni-Direction Propulsion Mechanism for Underwater Vehicles |
| Sep 2013 – May 2015  | Daniel Dulaney      | School Without Walls (SWW) | Omni-directional mobile robots locomotion                   |

## Teaching

### Courses Taught

#### Virginia Tech - Department of Mechanical Engineering

|                                                     |             |
|-----------------------------------------------------|-------------|
| Controls Engineering I (ME 3534)                    | Spring 2022 |
| Advanced Robotics and Automation (ME 5704/ECE 5704) | Fall 2021   |
| Robotics & Mechatronics Seminar (ME 4734)           | Fall 2021   |
| Controls Engineering I (ME 3534)                    | Spring 2021 |
| Engineering Design and Project II (ME4016)          | Spring 2021 |
| Mechanical Vibrations (ME 3524)                     | Fall 2020   |
| Engineering Design and Project I (ME4015)           | Fall 2020   |
| Advanced Robotics and Automation (ME 5704/ECE 5704) | Spring 2020 |
| Robotics Laboratory (ME 4584/ECE 4584)              | Spring 2020 |
| Robotics and Automation (ME 4524)                   | Spring 2020 |
| Principles of Robotics Systems (ECE 4704)           | Spring 2020 |
| Advanced Robotics and Automation (ME 5704/ECE 5704) | Spring 2019 |
| Robotics Laboratory (ME 4584/ECE 4584)              | Spring 2019 |
| Robotics and Automation (ME 4524)                   | Spring 2019 |

|                                                    |             |
|----------------------------------------------------|-------------|
| Principles of Robotics Systems (ECE 4704)          | Spring 2019 |
| Advanced Robotics and Automation (ME5704/ECE 5704) | Spring 2018 |
| Robotics Laboratory (ME 4584/ECE 4584)             | Spring 2018 |
| Robotics and Automation (ME 4524)                  | Spring 2018 |
| Principles of Robotics Systems (ECE 4704)          | Spring 2018 |
| Engineering Design and Project I (ME4015)          | Fall 2017   |
| Robotics and Automation (ME 4524)                  | Spring 2017 |
| Principles of Robotics Systems (ECE 4704)          | Spring 2017 |
| Robotics and Automation (ME 4524)                  | Spring 2016 |
| Principles of Robotics Systems (ECE 4704)          | Spring 2016 |
| Engineering Design and Project II (ME4016)         | Spring 2016 |
| System Dynamics (ME 3514)                          | Fall 2015   |
| Engineering Design and Project I (ME4015)          | Fall 2015   |

George Washington University - Department of Mechanical & Aerospace Engineering

|                                                    |             |
|----------------------------------------------------|-------------|
| Robotic Systems (MAE 6245)                         | Spring 2015 |
| Mechatronics Design (MAE 4194)                     | Spring 2015 |
| Electromechanical Control System Design (MAE 4182) | Fall 2014   |
| Robotic Systems (MAE 6245)                         | Spring 2014 |
| Mechatronics Design (MAE 4194)                     | Spring 2014 |
| Analysis and Synthesis of Mechanisms (MAE 3190)    | Fall 2013   |
| Robotic Systems (MAE 6245)                         | Spring 2013 |
| Mechatronics Design (MAE 4194)                     | Spring 2013 |
| Analysis and Synthesis of Mechanisms (MAE 3190)    | Fall 2012   |
| Robotic Systems (MAE 6245)                         | Spring 2012 |
| Mechatronics Design (MAE 4194)                     | Spring 2012 |
| Electromechanical Control System Design (MAE 4182) | Fall 2011   |
| Robotic Systems (MAE 6245)                         | Spring 2011 |
| Mechatronics Design (MAE 4194)                     | Spring 2011 |
| Electromechanical Control System Design (MAE 4182) | Fall 2010   |
| Mechatronics Design (MAE 4194)                     | Spring 2010 |
| Introduction to Vibration Analysis (MAE 3134)      | Spring 2010 |
| Electromechanical Control System Design (MAE 4182) | Fall 2009   |
| Introduction to Vibration Analysis (MAE 3134)      | Spring 2009 |

University of Toronto – Department of Mechanical & Industrial Engineering

|                                |                         |
|--------------------------------|-------------------------|
| Computer Aided Design (MIE441) | Winter 2006, 2007, 2008 |
|--------------------------------|-------------------------|

|                                                                                                                                                                                                                                |                                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| Introduction to Computer Aided Design (Short Course)                                                                                                                                                                           | Winter, Spring, Fall 2007, Winter 2008 |
| Control Systems (MIE372)<br>Co-Instructor (with Prof. A.A. Goldenberg)                                                                                                                                                         | Fall 2003, 2004                        |
| <u>University of Toronto – Faculty of Applied Science and Engineering</u>                                                                                                                                                      |                                        |
| Artificial Intelligence and Robotics                                                                                                                                                                                           | Fall 2006                              |
| Mechatronics and Artificial Intelligence                                                                                                                                                                                       | Summer 2005                            |
| Mechatronics Design and Operation                                                                                                                                                                                              | Fall 2004                              |
| Mechatronics                                                                                                                                                                                                                   | Summer 2004                            |
| <u>Technion - Israel Institute of Technology</u>                                                                                                                                                                               |                                        |
| Instructor, Physics Courses – Mechanics                                                                                                                                                                                        | July 1999–July 2000                    |
| <u>Israeli Air Force Academy</u>                                                                                                                                                                                               |                                        |
| Senior Instructor, Engineering Courses<br>Courses taught: Control Systems, Mechanics and Control Lab,<br>Mechanical Machining Lab, Hydraulics Lab, Pneumatics Lab,<br>CNC Lab, Engineering Drafting, Computer Aided Design Lab | May 1993–April 1996                    |

### Teaching Expertise & Interests

The following is a selected list of my teaching experiences and interests:

#### System Dynamics and Control

- Analysis & Design of Feedback Control Systems
- Automatic Control Systems
- Linear & Nonlinear Control Systems
- Modeling and Simulation of Dynamic Systems

#### Mechatronics

- Mechatronic Systems Design
- Mechatronics Principles
- Microcontroller-based Systems Design
- Sensors, Actuators & Measurement

#### Core Courses

- Statics
- Dynamics and Vibrations
- Electrical Circuits

#### Robotics and Automation

- Industrial Automation Systems Design
- Robotic Systems Design
- Robot Kinematics, Dynamics & Control
- Design of Electromechanical Mobile Robots

#### Design and Manufacturing

- Precision Mechanism Analysis & Synthesis
- Electromechanical Machine Design
- Computer Aided Design (CAD)
- System Design & Analysis (FEA)

---

## Service to Profession and Field

---

### A. Professional Service

#### A1. Workshops Organized (in my role as Program Director at NSF)

- [1] *NSF EPSCoR Workshop on Quantum Computing, Information, Science, and Engineering*, National Science Foundation (NSF), Alexandria, VA, March 23-24, 2023.

## A2. Conference General Chair

**General Chair**, IEEE International Symposium on Robotic and Sensors Environments – IEEE ROSE 2013, Washington, DC, 21-23 October 2013.

## A3. Conference Technical Program Committees – Chair / Co-Chair

- **Chair** of the Technical Program Committee for the 44th Mechanisms and Robotics Conference at the 2020 ASME International Design Engineering Technical Conferences (IDETC/CIE), August 2020, St. Louis, MO, USA.
- **Co-Chair** of the Technical Program Committee for the 43rd Mechanisms and Robotics Conference at the 2019 ASME International Design Engineering Technical Conferences (IDETC/CIE), August 2019, Anaheim, CA, USA.
- **Chair** for Workshops, Tutorials and Special Sessions for the 2017 ASME Dynamic Systems and Control Conference – DSCC 2017, Tysons Corner, VA, 11-13 Oct. 2017.
- **Co-Chair** of the Technical Program Committee for the 10th IEEE International Symposium on Robotic and Sensors Environments – ROSE 2012, Magdeburg, Germany, 16-18 Nov. 2012.
- **Co-Chair** of the Technical Program Committee for the 7th IEEE International Workshop on Robotic and Sensors Environments – ROSE 2009, Lecco, Italy, 6-7 November 2009.

## A4. Symposium Chair / Co-Chair

**Symposium Co-Chair**, Mobile Robotics Symposium, 42nd Mechanisms and Robotics Conference at the 2018 ASME International Design Engineering Technical Conferences (IDETC/CIE), August 26-29, 2018, Quebec City, Canada.

## A5. Conference Technical Program Committees – Member

- **Member** of the Technical Program Committee for the 2019 IEEE International Conference on Mechatronics and Automation - IEEE ICMA 2019, Tianjin, China, 4-7 Aug. 2019.
- **Member** of the Technical Program Committee for the 2019 IEEE International Workshop on Robotic and Sensors Environments - ROSE 2019, Ottawa, Canada, 17-18 June 2019.
- **Member** of the Organizing Committee for the 2018 International Conference on Mechatronics Systems and Control Engineering – ICMSCE 2018, Amsterdam, Netherlands, 21-23 Feb. 2018.
- **Member** of the Technical Program Committee for the 2017 IEEE International Conference on Robotics and Biomimetics – ROBIO 2017, Macau SAR, China, 5-8 Dec. 2017.
- **Member** of the Technical Program Committee for the 2017 IEEE International Conference on Mechatronics and Automation - IEEE ICMA 2017, Takamatsu, Japan, 6-9 Aug. 2017.
- **Member** of the Organizing Committee for the 2017 International Conference on Mechatronics Systems and Control Engineering – ICMSCE 2017, Kayseri, Turkey, 2-4 Feb. 2017.
- **Member** of the Technical Program Committee for the 2016 IEEE International Conference on Robotics and Biomimetics – ROBIO 2016, Qingdao, China, 3-7 Dec. 2016.

- **Member** of the Technical Program Committee for the 2016 IEEE International Conference on Mechatronics and Automation - IEEE ICMA 2016, Harbin, China, 7-10 Aug. 2016.
- **Member** of the Technical Editorial Board for the 2016 CSME (Canadian Society for Mechanical Engineering) International Congress – Symposium on Control and Robotics, Kelowna, BC, Canada, 26-29 June 2016.
- **Member** of the Technical Program Committee for the 2015 IEEE International Conference on Robotics and Biomimetics – ROBIO 2015, Zhuhai, China, 6-9 Dec. 2015.
- **Member** of the Technical Program Committee for the 2014 IEEE International Conference on Robotics and Biomimetics – ROBIO 2014, Bali, Indonesia, 5-10 Dec. 2014.
- **Member** of the Technical Program Committee for the 12th IEEE International Symposium on Robotic and Sensors Environments – ROSE 2014, Timisoara, Romania, 16-18 Oct. 2014.
- **Member** of the Technical Program Committee for the 2014 IEEE International Conference on Mechatronics and Automation - IEEE ICMA 2014, Takamatsu, Tianjin, China, 3-6 Aug. 2014.
- **Member** of the Technical Program Committee for the 2014 Robotics Science and Systems Conference – RSS 2014, Berkeley, CA, USA, July 12–16, 2014.
- **Member** of the Technical Program Committee for the 2013 IEEE International Conference on Mechatronics and Automation - IEEE ICMA 2013, Takamatsu, Kagawa, Japan, 4-7 Aug. 2013.
- **Member** of the Technical Program Committee for the 2012 IEEE International Conference on Mechatronics and Automation - IEEE ICMA 2012, Chengdu, Sichuan, China, 5-8 Aug. 2012.
- **Member** of the Technical Program Committee for the 9th IEEE International Symposium on Robotic and Sensors Environments – ROSE 2011, Montréal, Québec, Canada, 17-18 Sep. 2011.
- **Member** of the Technical Program Committee for the 7th ASME/IEEE Int. Conf. on Mechatronics & Embedded Systems & Applications – MESA 2011, Washington, DC, August 28-31, 2011
- **Member** of the Technical Program Committee for the 2011 IEEE International Conference on Mechatronics and Automation - IEEE ICMA 2011, Beijing, China, 7-10 August 2011.
- **Member** of the Technical Program Committee for the 8th IEEE International Workshop on Robotic and Sensors Environments - ROSE 2010, Phoenix, Arizona, 15-16 October 2010.
- **Member** of the Technical Program Committee for the 6th IEEE International Workshop on Robotic and Sensors Environments - ROSE 2008, Ottawa, Canada, 17-18 October 2008.

#### A6. Expert Panels Chair/Reviewer and Proposal Reviewer

- |                                                                                                                                                                                                                           |      |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|
| ➤ <b>Proposal Reviewer</b> , Czech Science Foundation, Czech Republic                                                                                                                                                     | 2022 |
| ➤ <b>Panelist at a Study Section</b> , National Institutes of Health (NIH)<br>SRO, Bioengineering, Technology, and Surgical Sciences (BTSS) Study Section<br>Surgical Sciences, Biomedical Imaging and Bioengineering IRG | 2021 |
| ➤ <b>Reviewer</b> , Mitacs, Canadian Network of Centres of Excellence, Canada                                                                                                                                             | 2019 |
| ➤ <b>Proposal Reviewer</b> , National Research Foundation, Prime Minister's Office, Singapore                                                                                                                             | 2019 |
| ➤ <b>Proposal Reviewer</b> , Natural Sciences & Eng Research Council of Canada (NSERC)                                                                                                                                    | 2018 |

- **Proposal Reviewer**, Israeli Ministry of Science and Technology August 2018  
Topic: Robotics, Medical Devices and Big Data
- **Panelist**, IIHCC Industry Roundtable – Virginia Tech Applied Research Corp. Nov. 2017  
*Intelligent Infrastructure for Human-Centered Communities (IIHCC)*
- **Panelist**, Red Teaming Round Table – Virginia Tech Applied Research Corp. Nov. 2016  
*Fully-Autonomous Drone Swarms*; Office of the Deputy Assistant Secretary of the Army R&T
- **Expert Reviewer**, Canada Foundation for Innovation (CFI) Jul – Oct 2016  
*2015 Innovation Fund (IF) Competition*
- **Panelist**, National Science Foundation – National Robotics Initiative (NRI) June 2016  
Division for Electrical, Communications and Cyber Systems (ECCS)
- **Panelist**, National Science Foundation – CISE/IIS/Robust Intelligence (NRI) May 2015  
Division of Information and Intelligent Systems
- **Proposal Reviewer**, Canadian Institutes of Health Research (CIHR) December 2014
- **Panelist**, NSF CAREER – CMMI / Sensors, Dynamics & Control Programs Sep 2014
- **Chair of Expert Committee**, Canada Foundation for Innovation (CFI) Jul – Oct 2014  
*2015 Innovation Fund (IF) Competition*
- **Panelist**, National Science Foundation – CMMI / Dynamical Systems May 2014
- **Proposal Reviewer**, National Science Foundation – CISE/Robust Intelligence Feb 2014
- **Proposal Reviewer**, Natural Sciences & Eng Research Council of Canada (NSERC) 2012-2014
- **Panelist**, U.S. Army Medical Robotics Product Line Review (PLR) Expert Panel October 2012  
U.S. Army Telemedicine & Advanced Technology Research Center (TATRC)
- **Panelist**, National Science Foundation – National Robotics Initiative (NSF-NRI) June 2012
- **Panel Chair**, National Defense Science & Eng. Graduate (NDSEG) Fellowship Feb 2012
- **Panelist**, Air Force Summer Faculty Fellowship Program (AF SFFP) Jan 2010, 2011
- **Panelist**, NSF Graduate Research Fellowship Program (GRFP) Feb 2010, 2011, 2012, 2013
- **Panelist**, National Defense Science & Eng. Graduate (NDSEG) Fell. 2010, 2011, 2012, 2015
- **Panelist**, ONR Summer Faculty Research Program (ONR SFRP) Feb 2011, 2012
- **Panelist**, DOD Science, Mathematics & Research for Transformation 2011, 2012, 2015, 2016  
(SMART) Defense Scholarship for Service Program
- **Panelist**, NASA Aeronautics Scholarship Program (NASA ASP) Feb 2011, 2012, 2013
- **Panelist**, NSF East Asia and Pacific Summer Institutes (EAPSI) Jan 2010
- **Proposal Reviewer**, India Science & Technology Partnership (INSTP) April 2009  
Invited by the Smithsonian Institution, INDO-US Science & Technology Forum, Washington, DC

## A7. Technical Editorial and Reviewer

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| <b>Associate Editor - Journal</b><br>Robotics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | May 2021 – Aug. 2022   |
| <b>Technical Editor - Journal</b><br>IEEE/ASME Transactions on Mechatronics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | July 2016 – April 2021 |
| <b>Guest Editor - Journal</b><br>ASME Journal of Mechanisms and Robotics (special issue)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | June 2020 – April 2021 |
| <b>Guest Editor - Journal</b><br>ASME Journal of Mechanisms and Robotics (special issue)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | June 2019 – April 2020 |
| <b>Associate Editor - Journal</b><br>ASME Journal of Mechanisms and Robotics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Jan. 2018 – Jan. 2021  |
| <b>Associate Editor - Journal</b><br>IEEE Robotics and Automation Magazine                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Oct. 2017 – Dec. 2021  |
| <b>Associate Editor - Journal</b><br>International Journal of Control, Automation and Systems                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Jan. 2011 – Jan. 2021  |
| <b>Associate Editor – Conference</b><br>IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2022)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 2021–2022              |
| IEEE International Conference on Robotics and Automation (ICRA 2018)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2017–2018              |
| IEEE International Conference on Robotics and Automation (ICRA 2017)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2016–2017              |
| ASME Dynamic Systems and Control Conference (DSCC 2017)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 2017                   |
| IEEE International Conference on Robotics and Automation (ICRA 2016)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2015–2016              |
| IEEE International Conference on Robotics and Automation (ICRA 2014)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2013–2014              |
| IEEE International Conference on Robotics and Automation (ICRA 2013)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 2012–2013              |
| <b>Journal Reviewer (2007 – current):</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |
| <ul style="list-style-type: none"><li>• IEEE Transactions on Robotics</li><li>• IEEE Robotics and Automation Letters</li><li>• IEEE/ASME Transactions on Mechatronics</li><li>• Transactions of the ASME, Journal of Mechanical Design</li><li>• Transactions of the ASME, Journal of Mechanisms and Robotics</li><li>• Transactions of the ASME, Journal of Dynamic Systems, Measurement and Control</li><li>• Journal of Field Robotics</li><li>• Journal of Robotics and Autonomous Systems</li><li>• Journal of Intelligent and Robotic Systems</li><li>• Robotica Journal</li><li>• Mechatronics Journal</li><li>• IEEE Sensors Journal</li><li>• IEEE Transactions on Systems, Man, and Cybernetics – Part A: Systems &amp; Humans</li><li>• IEEE Transactions on Nanotechnology</li><li>• Journal of Intelligent Service Robots (ISR)</li></ul> |                        |

- Autonomous Robots
- Journal of Biomedical Microdevices

**Conference Proceedings Reviewer** (2004 – current):

- IEEE International Conference on Robotics and Automation (ICRA)
- IEEE International Conference on Intelligent Robots and Systems (IROS)
- IEEE International Workshop on Robotic and Sensors Environments (ROSE)
- IEEE International Conference on Mechatronics and Automation (ICMA)
- ASME International Mechanical Engineering Congress and Exposition (IMECE)
- Dynamic Systems and Control Conference (DSCC)
- IEEE Conference on Automation Science and Engineering (CASE)
- IEEE Conference on Decision and Control (CDC)
- IEEE RAS/EMBS Int. Conference on Biomedical Robotics and Biomechanics (BioRob)
- IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM)
- American Control Conference
- ASME International Design Engineering Technical Conferences (IDETC/CIE)
- ASME/IFTOMM International Conference on Reconfigurable Mechanisms and Robots
- IASTED Conference on Robotics and Applications

**Book Proposals Reviewer**

- Fundamentals and Applications of Nanopositioning Technologies Mar. 2014  
Publisher: Springer; Edited by: Changhai Ru, Xinyu Liu, and Yu Su

**A8. Professional Meetings, Workshops, Etc. Chaired or Organized**

- **Session Chair**, Technical Session: “Prosthetics, exoskeletons and Rehabilitation”, *Proc. of the 2023 IEEE International Conference on Robotics and Automation (ICRA2023)*, London, UK, May 29-June 2, 2023.
- **Session Chair**, Technical Session: “Novel Mechanisms, Robots, and Applications”, Topic: TBD1”; *ASME IDETC/CIE 2021, 46<sup>th</sup> Mechanisms & Robotics Conference*, St. Louis, Missouri, Aug. 14-17, 2022.
- **Session Chair**, Technical Session: “Novel Mechanisms, Robots, and Applications”, Topic: TBD2”; *ASME IDETC/CIE 2021, 46<sup>th</sup> Mechanisms & Robotics Conference*, St. Louis, Missouri, Aug. 14-17, 2022.
- **Session Chair**, Technical Session: “Motion Planning”, Topic: “Dynamics, and Control of Robots”; *ASME IDETC/CIE 2021, 45<sup>th</sup> Mechanisms & Robotics Conference*, Virtual Conference, Aug. 17-19, 2021.
- **Session Chair**, Technical Session: “Ions, Hydrogels, LC Elastomers, and Coiled Artificial Muscle Heat Pumping”, *2020 SPIE Smart Structures and Nondestructive Evaluation (EAPAD 2020) Conference*, Anaheim, CA, April 26-30, 2020.
- **Session Chair**, Technical Session: “Autonomous Vehicle Navigation II”, *2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Macau, China, November 4-8, 2019.

- **Session Organizer**, Technical Session: “Humanlike Robots - The Ultimate Challenge to Biomimetics”, *ASME IDETC/CIE 2018, 43<sup>rd</sup> Mechanisms & Robotics Conference*, Anaheim, CA, Aug. 18-21, 2019.
- **Session Chair**, Technical Session: “Motion Planning”, Topic: “Mobile Robotics”; *ASME IDETC/CIE 2018, 42<sup>nd</sup> Mechanisms & Robotics Conference*, Quebec City, Canada, Aug. 26-29, 2018.
- **Session Co-Chair**, Technical Session: “Upper Extremity”, Topic: “Medical & Rehabilitation Robotics”; *ASME IDETC/CIE 2018, 42<sup>nd</sup> Mechanisms & Robotics Conference*, Quebec City, Canada, Aug. 26-29, 2018.
- **Session Chair**, Technical Session: “Robot Design and Development”, *2018 International Conference on Mechatronics Systems and Control Engineering – ICMSCE 2018*, Amsterdam, Netherlands, 21-23 Feb. 2018.
- **Session Co-Organizer**, Technical Session: “Design and Control of Robots, Mechanisms and Structures I”, Track: “Dynamics, Vibration, and Control”; Topic: “Design and Control of Robots, Mechanisms and Structures”; *ASME International Mechanical Engineering Congress and Exposition – IMECE 2017*, Tampa, FL, 3-9 Nov. 2017.
- **Session Co-Chair**, Technical Session: “Unmanned, Ground and Surface Robotics I”, 2017 ASME Dynamic Systems and Control Conference – DSCC 2017, Tysons Corner, VA, 11-13 Oct. 2017.
- **Session Co-Chair**, Technical Session: “Unmanned, Ground and Surface Robotics III”, 2017 ASME Dynamic Systems and Control Conference – DSCC 2017, Tysons Corner, VA, 11-13 Oct. 2017.
- **Session Chair**, Technical Session: “Mobile Robots”, *2017 IEEE Conference on Control Technology and Applications*, Kohala Coast, Hawai'i, Aug. 27–30, 2017
- **Session Co-Chair**, Technical Session: “Assistive Devices”, Topic: “Medical & Rehabilitation Robotics”; *ASME IDETC/CIE 2017, 41<sup>st</sup> Mechanisms & Robotics Conference*, Cleveland, OH, Aug. 6-9, 2017.
- **Session Chair**, Technical Session: “Mobile Robots”, Topic: “Novel Mechanisms, Robots and Applications”; *ASME IDETC/CIE 2016, 40<sup>th</sup> Mechanisms & Robotics Conference*, Charlotte, NC, Aug. 21-24, 2016.
- **Session Organizer**, Technical Session: “Mobile Robots”, Topic: “Novel Mechanisms, Robots and Applications”; *ASME IDETC/CIE 2016, 40<sup>th</sup> Mechanisms & Robotics Conference*, Charlotte, NC, Aug. 21-24, 2016.
- **Session Co-Organizer**, Technical Session: “Modeling, Analysis, and Estimation”, Topic: “Mobile Robots, Motion Planning, Dynamics and Control”; *ASME IDETC/CIE 2016, 40<sup>th</sup> Mechanisms & Robotics Conference*, Charlotte, NC, Aug. 21-24, 2016.
- **Session Chair**, Technical Session: “Modeling and Control of Mobile Robots”, Topic: “Mobile Robots and Cable-Driven Systems”; *ASME IDETC/CIE 2015, 39<sup>th</sup> Mechanisms & Robotics Conference*, Boston, MA, Aug. 2-5, 2015.
- **Session Chair**, Technical Session: “Developments in sUAV: From Payload to Safety”, Topic: “Small Unmanned Aerial Vehicle Technologies and Applications”; *ASME IDETC/CIE 2015*,

*ASME/IEEE International Conference on Mechatronic and Embedded Systems and Applications (MESA)*, Boston, MA, Aug. 2-5, 2015.

- **Session Chair**, Technical Session: “Bioinspired Mechanisms and Robots II”, Topic: “Symposium on Biologically Inspired and Health Motivated Mechanisms and Robotics”; *ASME IDETC/CIE 2014, 38th Mechanisms & Robotics Conference*, Buffalo, NY, Aug. 17-20, 2014.
- **Session Co-Chair**, Technical Session: “Surgical and Rehabilitation Robotics”, Topic: “Symposium on Biologically Inspired and Health Motivated Mechanisms and Robotics”; *ASME IDETC/CIE 2014, 38th Mechanisms & Robotics Conf.*, Buffalo, NY, Aug. 17-20, 2014.
- **Session Chair**, Technical Session: “Collaborative Robotics & Distributed Sensing”, *IEEE International Symposium on Robotic & Sensors Environments – ROSE 2013*, Washington, DC, Oct. 21-23, 2013.
- **Session Chair**, Technical Session: “Robotic Dynamics”, Track: “Dynamic Systems and Control”; Topic: “Dynamics and Control of Mechanisms and Robots”; *ASME International Mechanical Engineering Congress & Exposition – IMECE 2011*, Denver, CO, 11-17 Nov. 2011.
- **Session Organizer**, Technical Session: “Biomedical Mechatronics”, Track: “Mechatronics & Intelligent Machines”; Topic: “Symposium on Biomedical Mechatronics”; *ASME International Mechanical Engineering Congress and Exposition – IMECE 2011*, Denver, CO, 11-17 Nov. 2011.
- **Session Organizer**, Technical Session: “Robotics, Actuators and Sensors V”, Track: “Mechatronics & Intelligent Machines”; Topic: “Symposium on Robotics, Actuators and Sensors”; *ASME Int’l Mechanical Eng. Congress & Expo. – IMECE 2011*, Denver, CO, 11-17 Nov. 2011.
- **Session Chair**, Technical Session: “Localization Systems”, *IEEE International Symposium on Robotic & Sensors Environments – ROSE 2011*, Montreal, Quebec, Canada, Sep. 17-18, 2011.
- **Session Chair**, Technical Session: “Robot Control”, Track: “Dynamic Systems and Control”; Topic: “Symposium on Dynamics and Control of Mechanisms and Robots”; *ASME International Mechanical Engineering Congress and Exposition – IMECE 2010*, Vancouver, BC, 12-18 November 2010.
- **Session Co-Chair**, Technical Session: “Robot Control II”, Track: “Dynamic Systems and Control”; Topic: “Symposium on Dynamics and Control of Mechanisms and Robots”; *ASME International Mechanical Engineering Congress and Exposition – IMECE 2010*, Vancouver, BC, 12-18 November 2010.
- **Session Chair**, Technical Session: “Wireless and Distributed Sensing Networks”, *IEEE International Workshop on Robotic and Sensors Environments – ROSE 2010*, Phoenix, Arizona, 15-16 October 2010.
- **Session Co-Chair**, Technical Session: “Vibration and Control of Mechanical Systems”, *ASME International Mechanical Engineering Congress and Exposition – IMECE 2009*, Lake Buena Vista, FL, 13-19 November 2009.

#### A9. Advisory/Technical Committee Memberships

- **Member**, IEEE Robotics and Automation Society, Mechanisms and Design Technical Committee (TC) 2017–Present
- **Elected Voting Member**, ASME Design Engineering Division, 2018–2022

## Mechanisms and Robotics Technical Committee (TC)

- **Program Advisory Committee**, Robotics & Mechatronics Systems Eng. Program 2011–Present  
University of Detroit, Mercy

### A10. Professional Memberships

- American Society of Mechanical Engineers (ASME) 2002 – Present
- Institute of Electrical & Electronics Engineers (IEEE) 2002 – Present
- IEEE Robotics and Automation Society (RAS) 2009 – Present
- Association for Unmanned Vehicle Systems International (AUVSI) 2008 – Present
- Society of Automotive Engineers (SAE) 2008 – Present
- The Israeli Robotics Association (IROB) 2018 – Present
- Robotics Technology Consortium (RTC) 2009 – 2014

### B. Departmental Service and Administrative Assignments

#### Virginia Tech

- **Member**, RADS Major Subcommittee 2022 – 2022  
Robotics, Autonomous, and Dynamical Systems (RADS)  
Mechanical Engineering Department
- **Member**, Graduate Program Committee 2015 – 2022  
Mechanical Engineering Department
- **Chair**, Faculty Search Committee (Dynamic Systems and Control) 2017 – 2018  
Mechanical Engineering Department
- **Chair**, Faculty Search Committee (Robotics Perception) 2017 – 2018  
Mechanical Engineering Department
- **Member**, Ad Hoc (P&T and TAC) Committee 2017 – 2019  
Mechanical Engineering Department
- **Coordinator**, Thrust Area Committee (TAC) 2017 – 2018  
Robotics, Autonomous, and Dynamical Systems (RADS)  
Mechanical Engineering Department
- **Mentor for Junior Faculty** 2018 – 2019  
Mechanical Engineering Department
- **Representative Member**, Thrust Area Committee (TAC) 2016 – 2019  
Robotics, Autonomous, and Dynamical Systems (RADS)  
Mechanical Engineering Department
- **Member**, Faculty Search Committee (Dynamic Systems & Control - Perception) 2016 – 2017  
Mechanical Engineering Department
- **Member**, Faculty Search Committee (Energy Area) 2015 – 2016  
Mechanical Engineering Department

### George Washington University

- Member, Sub-Committee for the Undergraduate Design Curriculum 2009 – 2015
- ABET Design Subcommittee 2010 – 2015
- Member, Academic Standards Committee 2009 – 2015
- Member, Laboratory Committee 2009 – 2015
- Member, Steering Committee  
Center for Biomimetics & Bioinspired Engineering (COBRE) 2009 – 2015
- Member, Faculty Search Committee  
Dept. of Mechanical & Aerospace Engineering, GWU 2010 – 2011
- Member, Faculty Search Committee  
Dept. of Computer Science, GWU 2009 – 2010
- Departmental Secretary, MAE Faculty Meetings 2009 – 2010

## **C. School/College Service and Administrative Assignments**

### Virginia Tech

- Faculty Judge, 2022 Senior Design Competition Expo April 2022
- Faculty Judge, 2021 Senior Design Competition Expo April 2021
- Faculty Judge, Torgersen Graduate Research Award Competition May 2019
- Faculty Judge, 2019 Senior Design Competition Expo May 2018
- Faculty Judge, 2018 Senior Design Competition Expo May 2018
- Faculty Judge, 2017 Senior Design Competition Expo May 2017
- Faculty Judge, 2016 Senior Design Competition Expo May 2016

### George Washington University

- Faculty Judge, 2015 R&D SEAS Showcase Feb 2015
- Faculty Judge, The Pelton Award for Outstanding Senior Project May 16, 2012
- Faculty Judge, 2012 R&D SEAS Showcase Feb 27, 2012
- Faculty Panelist, SEAS New Faculty Orientation August 24, 2011
- Faculty Panelist, SEAS New Faculty Orientation August 25, 2010
- Member, SEAS Biomedical Engineering (BME) Interest Group 2009 – 2015
- Member, Science and Engineering Hall (SEH) Planning Committee 2009 – 2015

- Member, SEAS Educational Initiatives (SEI) Committee Spring 2009  
*Undergraduate Programs in Robotics, and Energy & Sustainability*
- Affiliate Member, GW Institute for Nanotechnology (GWIN) 2013 – 2015
- Affiliate Member, GW Institute for Biomedical Engineering (GWIBE) 2009 – 2015
- Participated in various School of Engineering & Applied Science recruiting events and orientations for Graduate and Undergraduate students, including:
  - Graduate / Undergraduate Open Houses
  - Undergraduate recruiting events and orientations

As part of those activities, students tour the Robotics & Mechatronics Lab (RML) and I give talks about educational and research opportunities in SEAS through various demonstrations of research ongoing in RML.

## **D. University Service and Administrative Assignments**

### George Washington University

- Member, Faculty Governance Working Group on Appointment, Promotion & Tenure 2014–2015
- Member, Faculty Senate Committee on Professional Ethics & Academic Freedom 2012–2015
- Judging Team Member, GWU Research Day Apr 2014
- Judging Team Captain, GWU Research Day Apr 2013
- Reviewer, George Washington University Facilitating Fund UFF/Dilthey Award Jan. 2012, 2013
- Organizer, Robotics Workshops at the Science, Apr 2011, 2012, 2013, 2014  
Technology & Engineering Day  
Virginia Science and Technology Campus, GWU  
Workshop title: “Greater than the Sum of its Parts: Integrating a Robotic System”

**Dr. Pinhas Ben-Tzvi, journal articles, books, patents**

**PEER-REVIEWED JOURNAL PUBLICATIONS:**

- [76] Liu, Y., Ben-Tzvi, P., “How a Serpentine Tail Assists Agile Motions of Kangaroo Rats: A Dynamics and Control Approach”, *Nonlinear Dynamics*, Accepted, February 2023. <https://doi.org/10.21203/rs.3.rs-1315822/v1>
- [75] Xu, W., Guo, Y., Bravo, C.J., Ben-Tzvi, P., “Design, Control, and Experimental Evaluation of a Novel Robotic Glove System for Patients with Brachial Plexus Injuries”, *IEEE Transactions on Robotics*, Vol. 39, Issue 2, pp. 1637-1652, April 2023. DOI: 10.1109/TRO.2022.3220973
- [74] Han, X., Ren, H., Qi, J., Ben-Tzvi, P., “Autonomous Cricothyroid Membrane Detection and Manipulation using Neural Networks and Robot Arm for First-Aid Airway Management”, *Journal of Medical Devices, Transactions of the ASME*, Vol. 17, Issue 1, pp. 014502: 1-9, March 2023. DOI: <https://doi.org/10.1115/1.4056505>
- [73] Guo, Y., Xu, W., Pradhan, S., Bravo, C.J., Ben-Tzvi, P., “Personalized Voice Activated Grasping System for a Robotic Exoskeleton Glove”, *Mechatronics Journal*, Vol. 83, pp. 102745:1-12, May 2022. DOI: 10.1016/j.mechatronics.2022.102745
- [72] Sohal, S.S., Sebastian, B., Ben-Tzvi, P., “Autonomous Docking of Hybrid-Wheeled Modular Robots With an Integrated Active Genderless Docking Mechanism”, *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 14, Issue 1, pp. 011010: 1-15, February 2022. DOI: [doi.org/10.1115/1.4051519](https://doi.org/10.1115/1.4051519)
- [71] Njaka, T., Brizzolara, S., Ben-Tzvi, P., “Design and Experimental Validation of a Novel High-Speed Omnidirectional Underwater Propulsion Mechanism”, *IEEE/ASME Transactions on Mechatronics*, Vol. 26, Issue 5, pp. 2339-2349, October 2021. DOI: 10.1109/TMECH.2020.3037887
- [70] Guo, Y., Xu, W., Pradhan, S., Bravo, C.J., Ben-Tzvi, P., “Data Driven Calibration and Control for Compact Lightweight Series Elastic Actuators for Robotic Exoskeleton Gloves”, *IEEE Sensors Journal*, Vol. 21, Issue 19, pp. 21120-21130, October 2021. DOI:10.1109/JSEN.2021.3101143 \* Selected as a featured article
- [69] Yang, J., Saab, W., Liu, Y., Ben-Tzvi, P., “Reuleaux Triangle Based Two Degrees of Freedom Bipedal Robot”, *Robotics Journal*, Vol. 10, Issue 4, pp. 1-15, October 2021. DOI: 10.3390/robotics10040114
- [68] Liu, Y., Ben-Tzvi, P., “Dynamic Modeling, Analysis, and Design Synthesis of a Reduced Complexity Quadruped with a Serpentine Robotic Tail”, *Integrative and Comparative Biology*, Vol. 61, Issue 2, pp. 464-477, August 2021. DOI: 10.1093/icb/icab083

- [67] Liu, Y., Ben-Tzvi, P., "A New Extensible Continuum Manipulator Using Flexible Parallel Mechanism and Rigid Motion Transmission", *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 13, Issue 3, pp. 031112: 1-7, June 2021.  
DOI: doi.org/10.1115/1.4050097
- [66] Feng, S., Sebastian, B., Ben-Tzvi, P., "A Collision Avoidance Method Based on Deep Reinforcement Learning", *Robotics Journal*, Vol. 10, Issue 2, pp. 1-19, May 2021.
- [65] Ren, H., Qi, J., Ben-Tzvi, P., "Learning Flatness-Based Controller Using Neural Networks", *ASME Letters in Dynamic Systems and Control*, Vol. 1, Issue 2, pp. 021003: 1-6, April 2021.  
DOI: 10.1115/1.4046776
- [64] Wang, J., Liu, Y., Ben-Tzvi, P., "Robust Adaptive Input-Output Control for a Class of Modular Robotic Systems via Inverse Optimality Theory", *International Journal of Control*, Vol. 95, Issue 7, pp. 1898-1912, July 2022.  
DOI:10.1080/00207179.2021.1885741
- [63] Liu, Y., Ben-Tzvi, P., "Dynamic Modeling, Analysis, and Comparative Study of A Quadruped With Bio-Inspired Robotic Tails", *Multibody System Dynamics*, Vol. 51, Issue 2, pp. 195-219, February 2021. DOI: 10.1007/s11044-020-09764-8
- [62] Vanteddu, T., Ben-Tzvi, P., "Stable Grasp Control with a Robotic Exoskeleton Glove", *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 12, Issue 6, pp. 061015: 1-14, December 2020.
- [61] Wang, X., Ren, H., Kumar, A., Ben-Tzvi, P., "Design and Analysis of a Variable Inertia Spatial Robotic Tail for Dynamic Stabilization", *Biomimetics*, Vol. 5, Issue 4, pp. 1-16, November 2020. DOI: 10.3390/biomimetics5040055
- [60] Liu, Y., Ben-Tzvi, P., "An Articulated Closed Kinematic Chain Planar Robotic Leg for High Speed Locomotion", *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 12, Issue 4, pp. 041003: 1-15, August 2020. DOI: 10.1115/1.4045689
- [59] Liu, Y., Ben-Tzvi, P., "Design, Analysis and Integration of a New Two-DOF Articulated Multi-link Robotic Tail Mechanism", *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 12, Issue 2, pp. 021101: 1-9, April 2020. DOI: 10.1115/1.4045842
- [58] Ren, H., Ben-Tzvi, P., "Advising Reinforcement Learning Towards Scaling Agents in Continuous Control Environments with Sparse Rewards", *Journal to Engineering Applications of Artificial Intelligence*, Vol. 90, pp. 103515: 1-12, April 2020.  
DOI: 10.1016/j.engappai.2020.103515

- [57] Ren, H., Ben-Tzvi, P., "Learning Inverse Kinematics and Dynamics of a Robotic Manipulator using Generative Adversarial Networks", *Robotics and Autonomous Systems*, Vol. 124, pp. 103386: 1-12, February 2020. DOI: 10.1016/j.robot.2019.103386
- [56] Chauhan, R., Sebastian, B., Ben-Tzvi, P., "Grasp Prediction Towards Naturalistic Exoskeleton Glove Control", *IEEE Transaction on Human-Machine Systems*, Vol. 50, Issue 1, pp. 22-31, February 2020. DOI: 10.1109/THMS.2019.2938139
- [55] Refour, E., Sebastian, B., Chauhan, R., Ben-Tzvi, P., "A General Purpose Robotic Hand Exoskeleton with Series Elastic Actuators", *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 11, Issue 6, pp. 060902: 1-9, December 2019.
- [54] Williams, A., Sebastian, B., Ben-Tzvi, P., "Review and Analysis of Search, Extraction, Evacuation, and Medical Treatment Field Robots", *Journal of Intelligent and Robotic Systems*, Vol. 96, Issue 3, pp. 401-418, December 2019.
- [53] Budolak, D., Ben-Tzvi, P., "Series Elastic Actuation for Improved Transparency in Time Delayed Haptic Teleoperation", *Mechatronics Journal*, Vol. 63, pp. 102278:1-8, November 2019. DOI: 10.1016/j.mechatronics.2019.102278
- [52] Sebastian, B., Ben-Tzvi, P., "Support Vector Machine Based Real-time Terrain Estimation for Tracked Robots", *Mechatronics Journal*, Vol. 62, pp. 102260: 1-10, October 2019.
- [51] Liu, Y., Wang, J., Ben-Tzvi, P., "A Cable Length Invariant Robotic Tail Using a Circular Shape Universal Joint Mechanism", *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 11, Issue 5, pp. 051005: 1-14, October 2019.
- [50] Kumar, P., Ben-Tzvi, P., "Estimation of Wind Conditions Utilizing RC Helicopter Dynamics", *IEEE/ASME Transactions on Mechatronics*, Vol. 24, Issue 5, pp. 2293-2303, October 2019.
- [49] Ben-Tzvi, P., Saab, W., "A Hybrid Tracked-Wheeled Multi-Directional Mobile Robot", *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 11, Issue 4, pp. 041008: 1-10, August 2019.
- [48] Rone, W., Saab, W., Kumar, A., Ben-Tzvi, P., "Controller Design, Analysis and Experimental Validation of a Robotic Serpentine Tail to Maneuver and Stabilize a Quadrupedal Robot", *Journal of Dynamic Systems, Measurement and Control, Transactions of the ASME*, Vol. 141, Issue 8, pp. 081002: 1-9, August 2019.

- [47] Sebastian, B., Ben-Tzvi, P., "Physics Based Path Planning for Autonomous Tracked Vehicle in Challenging Terrain", *Journal of Intelligent and Robotic Systems*, Vol. 95, Issue 2, pp. 511-526, August 2019.
- [46] Racioppo, P., Ben-Tzvi, P., "Design and Control of an Articulated Cable-Driven Modular Snake Robot", *IEEE/ASME Transactions on Mechatronics*, Vol. 24, Issue 3, pp. 893-901, June 2019.
- [45] Ren, H., Kumar, A., Ben-Tzvi, P., "LOSA-X: Expandable 3D Motion Tracking System", *IEEE Sensors Journal*, Vol. 19, Issue 9, pp. 3288-3295, May 2019.
- [44] Saab, W., Rone, W., Kumar, A., Ben-Tzvi, P., "Design and Integration of a Novel Spatial Articulated Robotic Tail", *IEEE/ASME Transactions on Mechatronics*, Vol. 24, Issue 2, pp. 434-446, April 2019.
- [43] Sebastian, B., Ben-Tzvi, P., "Active Disturbance Rejection Control for Handling Slip in Tracked Vehicle Locomotion", *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 11, Issue 2, pp. 021003: 1-12, April 2019.
- [42] Williams, A., Sebastian, B., Ben-Tzvi, P., "A Robotic Head Stabilization Mechanism for Medical Transport", *Robotics Journal*, Vol. 8, Issue 1, pp. 1-16, March 2019.
- [41] Saab, W., Racioppo, P., Kumar, A., Ben-Tzvi, P., "Design of a Miniature Modular Inchworm Robot with an Anisotropic Friction Skin", *Robotica Journal*, Vol. 37, Issue 3, pp. 521-538, March 2019.
- [40] Saab, W., Racioppo, P., Ben-Tzvi, P., "A Review of Coupling Mechanism Designs for Modular Reconfigurable Robots", *Robotica Journal*, Vol. 37, Issue 2, pp. 378-403, February 2019.
- [39] Rone, W., Liu, Y., Ben-Tzvi, P., "Maneuvering and Stabilization Control of a Bipedal Robot with a Universal-Spatial Robotic Tail", *Bioinspiration and Biomimetics Journal*, Vol. 14, Issue 1, pp. 016014: 1-16, January 2019.
- [38] Liu, Y., Kong, M., Wan, N., Ben-Tzvi, P., "A Geometric Approach to Obtain the Closed-Form Forward Kinematics of H4 Parallel Robot", *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 10, Issue 5, pp. 051013: 1-9, October 2018.
- [37] Saab, W., Rone, W., Ben-Tzvi, P., "Robotic Tails: A State-of-The-Art Review", *Robotica Journal*, Vol. 36, Issue 9, pp. 1263-1277, September 2018.
- [36] Lee, J., Williams, A., Ben-Tzvi, P., "Intelligent Object Grasping with Sensor Fusion for Rehabilitation and Assistive Applications", *IEEE Transactions on Neural Systems & Rehabilitation Engineering*, Vol. 26, Issue 8, pp. 1556-1565, August 2018.

- [35] Rone, W., Saab, W., Ben-Tzvi, P., "Design, Modeling and Integration of a Flexible Universal Spatial Robotic Tail", *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 10, Issue 4, pp. 041001: 1-14, August 2018.
- [34] Saab, W., Rone, W., Ben-Tzvi, P., "Discrete Modular Serpentine Robotic Tail: Design, Analysis and Experimentation", *Robotica Journal*, Vol. 36, Issue 7, pp. 994-1018, July 2018.
- [33] Kumar, A., Ben-Tzvi, P., "Novel Wireless Sensing Platform for Experimental Mapping and Validation of Ship Air Wake", *Mechatronics Journal*, Vol. 52, pp. 58-69, June 2018.
- [32] Refour, E., Sebastian, B., Ben-Tzvi, P., "Two-Digit Robotic Exoskeleton Glove Mechanism: Design and Integration", *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 10, Issue 2, pp. 025002: 1-9, April 2018.
- [31] Yanga, Y., Ren, H., Yang, X., Ben-Tzvi, P., He, Z., "Optimal Interval of Periodic Polarity Reversal for Maximizing Hydrogen Production in Microbial Electrolysis Cells", *International Journal of Hydrogen Energy*, Vol. 42, Issue 31, pp. 20260–20268, Aug. 2017.
- [30] Saab, W., Rone, W., Ben-Tzvi, P., "Robotic Modular Leg: Design, Analysis and Experimentation", *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 9, Issue 2, pp. 024501: 1-6, April 2017.
- [29] Saab, W., Ben-Tzvi, P., "A Genderless Coupling Mechanism with 6-DOF Misalignment Capability for Modular Self-Reconfigurable Robots", *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 8, Issue 6, pp. 061014: 1-9, December 2016.
- [28] Ma, Z., Ben-Tzvi, P., Danoff, J., "Hand Rehabilitation Learning System with an Exoskeleton Robotic Glove", *IEEE Transactions on Neural Systems & Rehabilitation Engineering*, Vol. 24, Issue 12, pp.1323–1332, December 2016.
- [27] Zhao, H., Ben-Tzvi, P., "Synchronous Position Control Strategy for Bi-Cylinder Electro-pneumatic Systems", *International Journal of Control, Automation and Systems*, Vol. 14, Issue 6, pp. 1501-1510, December 2016.
- [26] Kumar, A., Ben-Tzvi, P., "Spatial Object Tracking System Based on Linear Optical Sensor Arrays", *IEEE Sensors Journal*, Vol. 16, Issue 22, pp. 7933-7940, November 2016.
- [25] Ben-Tzvi, P., Danoff, J., Ma, Z., "The Design Evolution of a Sensing and Force-Feedback Exoskeleton Robotic (SAFER) Glove for Hand Rehabilitation Application", *Journal of*

Mechanisms and Robotics, Transactions of the ASME, Vol. 8, Issue 5, pp. 051019: 1-9, October 2016.

- [24] Rone, W., Ben-Tzvi, P., "Dynamic Modeling and Simulation of a Yaw-Angle Quadraped Maneuvering with a Robotic Tail", Journal of Dynamic Systems, Measurement and Control, Transactions of the ASME, Vol. 138, Issue 8, pp. 084502: 1-7, August 2016.
- [23] Kumar, A., Ben-Tzvi, P., Saab, W., Snyder, M.R., "Wireless Telemetry System for Real-time Estimation of Ship Air Wake with UAVs", Mechatronics Journal, Vol. 36, pp. 18-26, June 2016.
- [22] Ben-Tzvi, P., Ma, Z., "Sensing and Force-Feedback Exoskeleton (SAFE) Robotic Glove", IEEE Transactions on Neural Systems & Rehabilitation Engineering, Vol. 23, Issue 6, pp. 992-1002, November 2015.
- [21] Ma, Z., Ben-Tzvi, P., "Design and Optimization of a Five-Finger Haptic Glove Mechanism", Journal of Mechanisms and Robotics, Transactions of the ASME, Vol. 7, Issue 4, pp. 041008: 1-8, November 2015.
- [20] Ma, Z., Ben-Tzvi, P., "RML Glove – An Exoskeleton Glove Mechanism with Haptics Feedback", IEEE/ASME Transactions on Mechatronics, Vol. 20, Issue 2, pp. 641-652, April 2015.
- [19] Rone, W., Ben-Tzvi, P., "Mechanics Modeling of Multi-Segment Rod-Driven Continuum Robots", Journal of Mechanisms and Robotics, Transactions of the ASME, Vol. 6, Issue 4, pp. 041006: 1-12, November 2014.
- [18] Moubarak, P., Ben-Tzvi, P., "A Tristate Rigid Reversible and Non-Back-Drivable Active Docking Mechanism for Modular Robotics", IEEE/ASME Transactions on Mechatronics, Vol. 19, Issue 3, pp. 840-851, June 2014.
- [17] Rone, W., Ben-Tzvi, P., "Continuum Robot Dynamics Utilizing the Principle of Virtual Power", IEEE Transactions on Robotics, Vol. 30, Issue 1, pp. 275-287, February 2014.
- [16] Moubarak, P., Ben-Tzvi, P., "A Globally Converging Algorithm for Adaptive Manipulation and Trajectory Following for Mobile Robots with Serial Redundant Arms", Robotica Journal, Vol. 31, Issue 8, pp. 1299-1312, December 2013.
- [15] Rone, W., Ben-Tzvi, P., "Design and FE Analysis of Integrated Sensing using Gas Compressibility for Microdroplet Generation", Mechatronics Journal, Vol. 23, Issue 4, pp. 397-408, June 2013.

- [14] Moubarak, P., Ben-Tzvi, P., "On the Dual-Rod Slider Rocker Mechanism and its Applications to Tri-State Rigid Active Docking", *Journal of Mechanisms and Robotics, Transactions of the ASME*, Vol. 5, Issue 1, pp. 011010: 1–10, February 2013.
- [13] Rone, W., Ben-Tzvi, P., "Mapping, Localization and Motion Planning in Mobile Multi-Robotic Systems", *Robotica Journal*, Vol. 31, Issue 1, pp. 1-24, January 2013.
- [12] Moubarak, P., Ben-Tzvi, P., "Modular and Reconfigurable Mobile Robotics", *Journal of Robotics and Autonomous Systems*, Vol. 60, Issue 12, pp. 1648-1663, December 2012.
- [11] Moubarak, P., Ben-Tzvi, P., Zaghloul, M.E., "A Self-Calibrating Mathematical Model for the Direct Piezoelectric Effect of a new MEMS Tilt Sensor", *IEEE Sensors Journal*, Vol. 12, Issue 5, pp. 1033-1042, May 2012.
- [10] Ben-Tzvi, P., Bai, S., Zhou, Q., Huang, X., "Fuzzy Sliding Mode Control of Rigid-Flexible Multi-Body Systems with Bounded Inputs", *Journal of Dynamic Systems, Measurement and Control, Transactions of the ASME*, Vol. 133, Issue 6, pp. 061012: 1–8, November 2011.
- [9] Bai, S., Ben-Tzvi, P., Zhou, Q., Huang, X., "Variable Structure Controller Design for Linear Systems with Bounded Inputs", *International Journal of Control, Automation and Systems*, Vol. 9, Issue 2, pp. 228–236, April 2011.
- [8] Ben-Tzvi, P., Goldenberg, A.A., Zu, J.W., "Articulated Hybrid Mobile Robot Mechanism with Compounded Mobility and Manipulation and On-Board Wireless Sensor/Actuator Control Interfaces", *Mechatronics Journal*, Vol. 20, Issue 6, pp. 627–639, September 2010.
- [7] Ben-Tzvi, P., "Experimental Validation and Field Performance Metrics of a Hybrid Mobile Robot Mechanism", *Journal of Field Robotics*, Vol. 27, Issue 3, pp. 250–267, May 2010.
- [6] Ben-Tzvi, P., Rone, W., "Microdroplet Generation in Gaseous and Liquid Environments", *Microsystem Technologies Journal*, Vol. 16, Issue 3, pp. 333–356, March 2010.
- [5] Ben-Tzvi, P., Ito, S., Goldenberg, A.A., "A Mobile Robot with Autonomous Climbing and Descending of Stairs", *Robotica Journal*, Vol. 27, Issue 02, pp. 171–188, Feb. 2009.
- [4] Zhou, Q., Ben-Tzvi, P., Fan, D., "Design and Analysis of a Fast Steering Mirror for Precision Laser Beams Steering", *Sensors & Transducers Journal*, Vol. 5, Issue 3, pp. 104-118, March 2009. \*\*\* Listed in the Top 25 List of Most Downloaded Articles in June 2011\*\*

- [3] Bai, S., Ben-Tzvi, P., Zhou, Q., Huang, X., "A Study on Dynamic Stiffening of a Rotating Beam with a Tip Mass", *Sensors & Transducers Journal*, Vol. 5, Issue 3, pp. 53-68, 2009.
- [2] Ben-Tzvi, P., Goldenberg, A.A., Zu, J.W., "Design and Analysis of a Hybrid Mobile Robot Mechanism with Compounded Locomotion and Manipulation Capability", *Journal of Mechanical Design*, *Transactions of the ASME*, Vol. 130, Issue 7, pp. 1–13, July 2008.
- [1] Ben-Tzvi, P., Ben Mrad, R., Goldenberg, A.A., "A Conceptual Design and FE Analysis of a Piezoceramic Actuated Dispensing System for Microdrops Generation in Microarray Applications", *Mechatronics Journal*, Vol. 17, Issue 1, pp. 1-13, February 2007.

#### **PEER-REVIEWED CONFERENCE PUBLICATIONS (FULL ARTICLES WITH FULL REVIEW)**

- [99] Guo, Y., Xu, W., Bravo, C., Ben-Tzvi, P., "Voice-based Human Machine Interface for Rehabilitation Exoskeleton Robotic Glove with Speaker Verification Feature Using One-shot Learning", *Proceedings of the 2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2023)*, Detroit, Michigan, October 1-5, 2023.
- [98] Xu, W., Guo, Y., Ben-Tzvi, P., "Robotic Exoskeleton Glove System Design and Simulation for Patients with Brachial Plexus Injuries", *Proceedings of the 2023 ASME IDETC/CIE, 47th Mechanisms & Robotics Conference*, Boston, MA, August 20-23, 2023. Accepted.
- [97] Xu, W., Guo, Y., Bravo, C.J., Ben-Tzvi, P., "Design, Control, and Experimental Evaluation of a Novel Robotic Glove System for Patients with Brachial Plexus Injuries", *Proc. of the 2023 IEEE International Conference on Robotics and Automation (ICRA2023)*, London, UK, May 2-June 2, 2023.
- [96] Xu, W., Guo, Y., Bravo, C., Ben-Tzvi, P., "Development and Experimental Evaluation of a Novel Portable Haptic Robotic Exoskeleton Glove System for Patients with Brachial Plexus Injuries", *Proceedings of the 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2022)*, Kyoto, Japan, October 23-27, 2022.
- [95] Xu, W., Liu, Y., Ben-Tzvi, P., "Development of a Novel Low-profile Robotic Exoskeleton Glove for Patients with Brachial Plexus Injuries", *Proceedings of the 2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2022)*, Kyoto, Japan, October 23-27, 2022.
- [94] Xu, W., Liu, Y., Ben-Tzvi, P., "Design, Analysis, and Prototyping of a Novel Single DOF Index Finger Exoskeleton Mechanism", *Proceedings of the 2022 ASME IDETC/CIE, 46th Mechanisms & Robotics Conference*, St. Louis, Missouri, August 14-17, 2022.

- [93] Pressgrove, I., Liu, Y., Ben-Tzvi, P., "Design and Implementation of a Power-Dense, Modular, and Compact Serpentine Articulated Robotic Tail", Proceedings of the 2022 ASME IDETC/CIE, 46th Mechanisms & Robotics Conference, St. Louis, Missouri, Aug 14-17, 2022.
- [92] Liu, Y., Ben-Tzvi, P., "Systematic Development of a Novel, Dynamic, Reduced Complexity Quadruped Robot Platform for Robotic Tail Research", Proc. of the 2022 IEEE International Conference on Robotics and Automation (ICRA2022), Philadelphia, PA, pp. 4664-4670, May 23-27, 2022.
- [91] Liu, Y., Ben-Tzvi, P., "Feedback Control of the Locomotion of a Tailed Quadruped Robot", Proceedings of the 2021 ASME IDETC/CIE, 45th Mechanisms & Robotics Conference, Virtual, Online, Aug. 17-20, 2021.
- [90] Guo, Y., Xu, W., Pradhan, S., Bravo, C.J., Ben-Tzvi, P., "Integrated and Configurable Voice Activation and Speaker Verification System for a Robotic Exoskeleton Glove", Proceedings of the 2020 ASME IDETC/CIE, 44th Mechanisms & Robotics Conference, St. Louis, MO, Aug. 16-19, 2020.
- [89] Xu, W., Pradhan, S., Guo, Y., Bravo, C.J., Ben-Tzvi, P., "A Novel Design of a Robotic Glove System for Patients with Brachial Plexus Injuries", Proceedings of the 2020 ASME IDETC/CIE, 44th Mechanisms & Robotics Conference, St. Louis, MO, Aug. 16-19, 2020.
- [88] Han, X., Ren, H., Ben-Tzvi, P., "Autonomous Cricothyroid Membrane Detection Using Neural Networks for First-Aid Surgical Airway Management", Proceedings of the 2020 ASME IDETC/CIE, 44th Mechanisms & Robotics Conference, St. Louis, MO, Aug. 16-19, 2020.
- [87] Liu, Y., Ben-Tzvi, P., "A New Extensible Continuum Manipulator Using Flexible Parallel Mechanism and Rigid Motion Transmission", Proceedings of the 2020 ASME IDETC/CIE, 44th Mechanisms & Robotics Conference, St. Louis, MO, Aug. 16-19, 2020.
- [86] Sohal, S.S., Ben-Tzvi, P., "Sensor Based Target Tracking with Application to Autonomous Docking and Self-Reconfigurability", Proceedings of the 2020 ASME IDETC/CIE, 44th Mechanisms & Robotics Conference, St. Louis, MO, Aug. 16-19, 2020.
- [85] Liu, Y., Ben-Tzvi, P., "Maneuvering and Stabilization of Reduced Complexity Legged Robots Using Bioinspired Robotic Tails", 2019 Do Good Robotics Symposium (DGRS), University of Maryland, College Park, MD, Oct. 3-4, 2019.
- [84] Chauhan, R., Ben-Tzvi, P., "A Series Elastic Actuator Design and Control in a Linkage Based Hand Exoskeleton", Proceedings of the ASME 2019 Dynamic Systems and Control Conf. (DSCC 2019), Park City, Utah, Oct. 8-11, 2019.

- [83] Ren, H., Qi, J., Ben-Tzvi, P., "Learning Flatness-Based Controller Using Neural Networks", Proceedings of the ASME 2019 Dynamic Systems and Control Conf. (DSCC 2019), Park City, Utah, Oct. 8-11, 2019.
- [82] Liu, Y., Ben-Tzvi, P., "A New Approach to Model the Constant Curvature Continuum Robot Dynamics", Proceedings of the ASME 2019 Dynamic Systems and Control Conf. (DSCC 2019), Park City, Utah, Oct. 8-11, 2019.
- [81] Yang, J., Saab, W., Ben-Tzvi, P., "A Two-DOF Bipedal Robot Utilizing the Reuleaux Triangle Drive Mechanism", Proceedings of the 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2019), Macau, China, pp. 4660-4665, Nov. 3–8, 2019.
- [80] Sebastian, B., Ren, H., Ben-Tzvi, P., "Neural Network Based Heterogeneous Sensor Fusion for Robot Motion Planning", Proceedings of the 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2019), Macau, China, pp. 2899-2904, Nov. 3–8, 2019.
- [79] Budolak, D., Chauhan, R., Ben-Tzvi, P., "Semi-Autonomous Teleoperation, Guidance, and Obstacle Avoidance with Path Adherence", Proceedings of the 2019 ASME IDETC/CIE, 43rd Mechanisms & Robotics Conference, Anaheim, CA, Aug. 18-21, 2019.
- [78] Sohal, S.S., Ben-Tzvi, P., "Image-Based Motion Analysis for Self-Reconfigurable Mobile Robots with Integrated Docking", Proceedings of the 2019 ASME IDETC/CIE, 43rd Mechanisms & Robotics Conference, Anaheim, CA, Aug. 18-21, 2019.
- [77] Njaka, T., Brizzolara, S., Ben-Tzvi, P., "Design and Simulation of a Novel High-Speed Omnidirectional Fully-Actuated Underwater Propulsion Mechanism", Proceedings of the 2019 ASME IDETC/CIE, 43rd Mechanisms & Robotics Conference, Anaheim, CA, Aug. 18-21, 2019.
- [76] Feng, S., Ren, H., Wang, X., Ben-Tzvi, P., "Mobile Robot Obstacle Avoidance Based on Deep Reinforcement Learning", Proceedings of the 2019 ASME IDETC/CIE, 43rd Mechanisms & Robotics Conference, Anaheim, CA, Aug. 18-21, 2019.
- [75] Liu, Y., Ben-Tzvi, P., "Design, Analysis, and Optimization of a New Two-DOF Articulated Multi-link Robotic Tail", Proceedings of the 2019 ASME IDETC/CIE, 43rd Mechanisms & Robotics Conference, Anaheim, CA, Aug. 18-21, 2019.
- [74] Kamidi, V., Williams, A., Ben-Tzvi, P., "A Framework for Modeling Closed Kinematic Chains with a Focus on Legged Robots", Proceedings of the 2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2018), Madrid, Spain, pp. 2733-2738, Oct. 1–5, 2018.

- [73] Saab, W., Yang, J., Ben-Tzvi, P., "Modeling and Control of an Articulated Tail for Maneuvering a Reduced Degree of Freedom Legged Robot", Proceedings of the 2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2018), Madrid, Spain, pp. 2695-2700, Oct. 1–5, 2018.
- [72] Vanteddu, T., Sebastian, B., Ben-Tzvi, P., "Design Optimization of RML Glove for Improved Grasp Performance", Proceedings of the ASME 2018 Dynamic Systems and Control Conf. (DSCC 2018), Atlanta, GA, Sep. 30 – Oct. 3, 2018.
- [71] Ren, H., Kumar, A., Wang, X., Ben-Tzvi, P., "Parallel Deep Learning Ensembles for Human Pose Estimation", Proceedings of the ASME 2018 Dynamic Systems and Control Conf. (DSCC 2018), Atlanta, GA, Sep. 30 – Oct. 3, 2018.
- [70] Wang, J., Kamidi, V., Ben-Tzvi, P., "A Multibody Toolbox for Hybrid Dynamic System Modeling Based on Nonholonomic Symbolic Formalism", Proceedings of the ASME 2018 Dynamic Systems and Control Conf. (DSCC 2018), Atlanta, GA, Sep. 30 – Oct. 3, 2018.
- [69] Chauhan, R., Ben-Tzvi, P., "Latent Variable Grasp Prediction for Exoskeletal Glove Control", Proceedings of the ASME 2018 Dynamic Systems and Control Conf. (DSCC 2018), Atlanta, GA, Sep. 30 – Oct. 3, 2018.
- [68] Refour, E., Sebastian, B., Ben-Tzvi, P., "Design and Implementation of an Exoskeleton Glove for Infant Medical Rehabilitation", Proceedings of the 2018 ASME IDETC/CIE, 42nd Mechanisms & Robotics Conference, Quebec City, Canada, Aug. 26-29, 2018.
- [67] Sohal, S.S., Saab, W., Ben-Tzvi, P., "Improved Alignment Estimation for Autonomous Docking of Mobile robots", Proceedings of the 2018 ASME IDETC/CIE, 42nd Mechanisms & Robotics Conference, Quebec City, Canada, Aug. 26-29, 2018.
- [66] Liu, Y., Ben-Tzvi, P., "Dynamic Modeling of a Quadruped with a Robotic Tail Using Virtual Work Principle", Proceedings of the 2018 ASME IDETC/CIE, 42nd Mechanisms & Robotics Conference, Quebec City, Canada, Aug. 26-29, 2018.
- [65] Sebastian, B., Williams, A., Ben-Tzvi, P., "Gaussian Kernel Controller for Path Tracking in Mobile Robots", Proceedings of the 2018 ASME IDETC/CIE, 42nd Mechanisms & Robotics Conference, Quebec City, Canada, Aug. 26-29, 2018.
- [64] Lee, J., Ben-Tzvi, P., "Design of a Wearable 3-DOF Forearm Exoskeleton for Rehabilitation and Assistive Purposes", Proceedings of the 2017 ASME International Mechanical Engineering Congress and Exposition (IMECE 2017), Tampa, Florida, Nov. 3–9, 2017.

- [63] Sebastian, B., Williams, A., Ben-Tzvi, P., "Control of a Head Stabilization System for Use in Robotic Disaster Response", Proceedings of the 2017 ASME International Mechanical Engineering Congress and Exposition (IMECE 2017), Tampa, Florida, Nov. 3–9, 2017.
- [62] Rone, W., Ben-Tzvi, P., "Design, Modeling and Optimization of the Universal-Spatial Robotic Tail", Proceedings of the 2017 ASME International Mechanical Engineering Congress and Exposition (IMECE 2017), Tampa, Florida, Nov. 3–9, 2017.
- [61] Kumar, A., Ben-Tzvi, P., "An Inertial Sensor to Measure Wind Turbulence with RC Helicopters", Proceedings of the ASME 2017 Dynamic Systems and Control Conf. (DSCC 2017), Tysons Corner, VA, Oct 11-13, 2017.
- [60] Saab, W., Ben-Tzvi, P., "Maneuverability and Heading Control of a Quadruped Robot Utilizing Tail Dynamics", Proceedings of the ASME 2017 Dynamic Systems and Control Conf. (DSCC 2017), Tysons Corner, VA, Oct 11-13, 2017.
- [59] Kumar, A., Ren, H., Ben-Tzvi, P., "Obstacle Identification for Vision Assisted Control Architecture of a Hybrid Mechanism Mobile Robot", Proceedings of the ASME 2017 Dynamic Systems and Control Conf. (DSCC 2017), Tysons Corner, VA, Oct 11-13, 2017.
- [58] Kamidi, V., Saab, W., Ben-Tzvi, P., "Design And Analysis of a Novel Planar Robotic Leg For High-Speed Locomotion", Proceedings of the 2017 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2017), Vancouver, Canada, pp. 6343–6348, Sep. 24–28, 2017.
- [57] Rone, W., Ben-Tzvi, P., "Maneuvering and Stabilizing Control of a Quadrupedal Robot using a Serpentine Robotic Tail", 2017 IEEE Conference on Control Technology and Applications, Kohala Coast, Hawai'i, pp. 1763–1768, Aug. 27–30, 2017.
- [56] Racioppo, P., Ben-Tzvi, P., "Modeling and Control of a Cable Driven Modular Snake Robot", 2017 IEEE Conference on Control Technology and Applications, Kohala Coast, Hawai'i, pp. 468–473, Aug. 27–30, 2017.
- [55] Williams, A., Saab, W., Ben-Tzvi, P., "Analysis of Differential Mechanisms for a Robotic Head Stabilization System", Proceedings of the 2017 ASME IDETC/CIE, 41st Mechanisms & Robotics Conference, Cleveland, Ohio, Aug. 6-9, 2017.
- [54] Refour, E., Sebastian, B., Ben-Tzvi, P., "Design and Integration of a Two-Digit Exoskeleton Glove", Proceedings of the 2017 ASME IDETC/CIE, 41st Mechanisms & Robotics Conference, Cleveland, Ohio, Aug. 6-9, 2017.

- [53] Racioppo, P., Saab, W., Ben-Tzvi, P., "Design and Analysis of Reduced Degree-of-Freedom Modular Snake Robot", Proceedings of the 2017 ASME IDETC/CIE, 41st Mechanisms & Robotics Conference, Cleveland, Ohio, Aug. 6-9, 2017.
- [52] Kumar, P., Saab, W., Ben-Tzvi, P., "Design of a Multi-Directional Hybrid-Locomotion Modular Robot with Feedforward Stability Control", Proceedings of the 2017 ASME IDETC/CIE, 41st Mechanisms & Robotics Conference, Cleveland, Ohio, Aug. 6-9, 2017.
- [51] Burns, C., Francom, M., Repisky, P., Kinney, A., Medina, B., Tello, E., Ben-Tzvi, P., "Development of Autonomous Robotic Cataract Surgery Device", Proceedings of the 2016 ASME IDETC/CIE, 40th Mechanisms & Robotics Conference, Charlotte, North Carolina, Aug. 21-24, 2016.
- [50] Saab, W., Ben-Tzvi, P., "Design and Analysis of a Miniature Modular Inchworm Robot", Proceedings of the 2016 ASME IDETC/CIE, 40th Mechanisms & Robotics Conference, Charlotte, North Carolina, Aug. 21-24, 2016.
- [49] Saab, W., Ben-Tzvi, P., "Design and Analysis of a Discrete Modular Robotic Tail for Improved Performance of Mobile Robots", Proceedings of the 2016 ASME IDETC/CIE, 40th Mechanisms & Robotics Conference, Charlotte, North Carolina, Aug. 21-24, 2016.
- [48] Saab, W., Ben-Tzvi, P., "Design and Analysis of a Robotic Modular Leg Mechanism", Proceedings of the 2016 ASME IDETC/CIE, 40th Mechanisms & Robotics Conference, Charlotte, North Carolina, Aug. 21-24, 2016.
- [47] Kumar, A., Ben-Tzvi, P., "Extraction of Impact of Wind Turbulence on RC Helicopters using Machine Learning", Proceedings of the 2016 ASME IDETC/CIE, 40th Mechanisms & Robotics Conference, Charlotte, North Carolina, Aug. 21-24, 2016.
- [46] Saab, W., Ben-Tzvi, P., "Development of a Novel Coupling Mechanism for Modular Self-Reconfigurable Mobile Robots", Proceedings of the 2015 ASME IDETC/CIE, 39th Mechanisms & Robotics Conference, Boston, MA, Aug. 2-5, 2015.
- [45] Rone, W., Ben-Tzvi, P., "Static Modeling of a Multi-Segment Serpentine Robotic Tail", Proceedings of the 2015 ASME IDETC/CIE, 39th Mechanisms & Robotics Conference, Boston, MA, Aug. 2-5, 2015.
- [44] Ma, Z., Ben-Tzvi, P., Danoff, J., "Sensing and Force-Feedback Exoskeleton Robotic (SAFER) Glove Mechanism for Hand Rehabilitation", Proceedings of the 2015 ASME IDETC/CIE, 39th Mechanisms & Robotics Conference, Boston, MA, Aug. 2-5, 2015.

- [43] Kumar, A., Ben-Tzvi, P., Snyder, M.R., "UAV-based Wireless Telemetry System for the Estimation of Ship Air Wake Patterns", Proc. of the 2015 ASME IDETC/CIE, 2015 ASME/IEEE International Conference on Mechatronic and Embedded Systems and Applications, Boston, MA, Aug. 2–5, 2015.
- [42] Ma, Z., Ben-Tzvi, P., "Modeling Human Hand and Sensing Hand Motions with the Five-Fingered Haptic Glove Mechanism", Proc. of the 2014 ASME Int'l Design Engineering Technical Conferences & Computers and Information in Engineering Conf. (IDETC/CIE 2014), 38th Mechanisms & Robotics Conference, Buffalo, NY, Aug. 17–20, 2014.
- [41] Rone, W., Ben-Tzvi, P., "Continuum Robotic Tail Loading Analysis for Mobile Robot Stabilization and Maneuvering", Proceedings of the 2014 ASME Int'l Design Engineering Technical Conferences & Computers and Information in Engineering Conf. (IDETC/CIE 2014), 38th Mechanisms & Robotics Conference, Buffalo, NY, Aug. 17–20, 2014.
- [40] Snyder, M.R., Kumar, A., Ben-Tzvi, P., "Off Ship Measurement of Ship Air Wakes Using Instrumented Unmanned Aerial Vehicles", 32nd AIAA Applied Aerodynamics Conference, AIAA Aviation and Aeronautics Forum and Exposition 2014, AIAA Paper 2014-3100, Atlanta, GA, 16-20 June 2014.
- [39] Rone, W., Ben-Tzvi, P., "Multi-Segment Continuum Robot Shape Estimation Using Passive Cable Displacements", Proceedings of the 2013 IEEE International Symposium on Robotic and Sensors Environments (ROSE 2013), Washington, DC, pp. 37–42, Oct. 21-23, 2013.
- [38] Ma, Z., Ben-Tzvi, P., "Tendon Transmission Efficiency of A Two-finger Haptic Glove", Proceedings of the 2013 IEEE International Symposium on Robotic and Sensors Environments (ROSE 2013), Washington, DC, pp. 13–18, Oct. 21-23, 2013.
- [37] Kumar, A., Ben-Tzvi, P., Snyder, M.R., Saab, W., "Instrumentation System for Ship Airwake Measurement", Proceedings of the 2013 IEEE Int'l Symposium on Robotic and Sensors Environments (ROSE 2013), Washington, DC, pp. 118–123, Oct. 21-23, 2013.
- [36] Moubarak, P., Alvarez, E., Ben-Tzvi, P., "Reconfiguring a Modular Robot into a Humanoid Formation: A Multi-Body Dynamic Perspective on Motion Scheduling for Modules and their Assemblies", Proc. of the 2013 IEEE International Conference on Automation Science and Engineering (CASE2013), Madison, Wisconsin, pp. 687–692, Aug. 17-21, 2013.
- [35] Moubarak, P., Ben-Tzvi, P., "Globally Converging MIMO Optimal Controller for Adaptive

- Manipulation of Mobile Robots with Redundant Arms”, Proceedings of the 2013 American Control Conference, Washington, DC, pp. 5729–5734, June 17–19, 2013.
- [34] Moubarak, P., Ben-Tzvi, P., Ma, Z., Alvarez, E., “An Active Coupling Mechanism with Three Modes of Operation for Modular Mobile Robotics”, Proc. of the 2013 IEEE International Conference on Robotics and Automation (ICRA2013), Karlsruhe, Germany, pp. 5469–5474, May 6-10, 2013.
  - [33] Snyder, M.R., Kumar, A., Ben-Tzvi, P., Kang, H.S., “Validation of Computational Ship Air Wakes for a Naval Research Vessel”, American Institute of Aeronautics and Astronautics (AIAA) 51<sup>st</sup> Aerospace Sciences Meeting, AIAA Paper 2013-0959, Grapevine, Texas, January 7-10, 2013. DOI: 10.2514/6.2013-959
  - [32] Rone, W., Ben-Tzvi, P., “Continuum Manipulator Statics Based on the Principle of Virtual Work”, Proceedings of the 2012 ASME International Mechanical Engineering Congress and Exposition (IMECE 2012), Houston, TX, pp. 321-328, November 9–15, 2012.
  - [31] Moubarak, P., Ben-Tzvi, P., Ma, Z., Alvarez, E., “Kinematic Synthesis and Dynamic Analysis of the Dual-Rod Slider Crank Mechanism: An Application to Modular Robotics”, Proceedings of the 2012 ASME IDETC/CIE, 36th Mechanisms & Robotics Conference, Chicago, IL, pp. 1073-1078, Aug. 12–15, 2012.
  - [30] Ma, Z., Ben-Tzvi, P., “An Admittance Glove Mechanism for Controlling a Mobile Robot”, Proceedings of the 2012 ASME IDETC/CIE, 36th Mechanisms & Robotics Conference, Chicago, IL, pp. 1109-1114, Aug. 12–15, 2012.
  - [29] Moubarak, P., Barsky, D., Ben-Tzvi, P., Zaghoul, M., “A Self-Calibrating Temperature Independent Model of a Bi-Axial Piezoelectric MEMS Tilt Sensor,” Proceedings of SPIE - Defense, Security, and Sensing, Micro- and Nanotechnology Sensors, Systems, and Applications IV Conference, Vol. 8373, 83732L-1, Baltimore, MD, April 23-27, 2012.
  - [28] Gilman, C., Ben-Tzvi, P., Yessin, G., Danoff, J., “A Robotic Wrist Exoskeleton Device for Augmenting Wrist Movement and Grip Function in Debilitated Patients”, Proceedings of the 2011 ASME International Mechanical Engineering Congress and Exposition (IMECE 2011), Denver, CO, pp. 1041-1050, November 11–17, 2011.
  - [27] Ma, Z., Ben-Tzvi, P., “An Admittance Type Haptic Device: RML Glove”, Proceedings of the 2011 ASME International Mechanical Engineering Congress and Exposition (IMECE 2011), Denver, CO, pp. 1219-1226, November 11–17, 2011.
  - [26] Gilani, O., Ben-Tzvi, P., “Bioinspired Jumping Mobility Concepts for Rough Terrain Mobile Robots”, Proceedings of the 2011 ASME International Mechanical Engineering Congress and Exposition (IMECE 2011), Denver, CO, pp. 207-214, November 11–17,

2011.

- [25] Gilani, O., Ben-Tzvi, P., "The Application of Bipinspired Jumping Locomotion Principles to Mobile Robots: Modeling and Analysis", Proceedings of the 2011 ASME Annual Dynamic Systems and Control Conf. (DSCC 2011), Arlington, VA, pp. 427-434, Oct 31–Nov 2, 2011.
- [24] Rone, W., Ben-Tzvi, P., "MEMS-Based Microdroplet Generation with Integrated Sensing", COMSOL Conference, Boston, MA, October 13-15, 2011.  
\*\*\* Winner of the Best Paper Award \*\*\*
- [23] Moubarak, P., Ben-Tzvi, P., "Design and Analysis of a New Piezoelectric MEMS Tilt Sensor", Proceedings of the 2011 IEEE International Symposium on Robotic and Sensors Environments (ROSE 2011), Montreal, Quebec, Canada, pp. 83–88, Sep. 17-18, 2011.
- [22] Moubarak, P., Ben-Tzvi, P., "Adaptive Manipulation of a Hybrid Mechanism Mobile Robot", Proceedings of the 2011 IEEE International Symposium on Robotic and Sensors Environments (ROSE 2011), Montreal, Quebec, Canada, pp. 113–118, Sep. 17-18, 2011.
- [21] Rone, W., Ben-Tzvi, P., "Finite Element Modeling of a Microdroplet Generator with Integrated Sensing", Proceedings of the 2011 ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conference (IDETC/CIE 2011), 2011 ASME/IEEE International Conference on Mechatronic and Embedded Systems and Applications (MESA2011), Washington, DC, Aug. 28–31, 2011.
- [20] Moubarak, P., Ben-Tzvi, P., Ma, Z., Dumas, M., "A Mobile Robotic Platform for Autonomous Navigation and Dexterous Manipulation in Unstructured Environments", Proceedings of the 2010 ASME International Mechanical Engineering Congress and Exposition (IMECE 2010), Vancouver, British Columbia, Canada, November 12–18, 2010.
- [19] Ben-Tzvi, P., Zhuk, M., "Real-time Dynamic Modeling and Virtual Prototype Simulation of Mechanical systems", Proceedings of the 2010 ASME International Mechanical Engineering Congress and Exposition (IMECE 2010), Vancouver, British Columbia, Canada, November 12–18, 2010.
- [18] Charifa, S., Ben-Tzvi, P., "Using Backpropagation Neural Network in Object Recognition for Hybrid Mechanism Mobile Robot", Proceedings of the 2010 ASME International Mechanical Engineering Congress and Exposition (IMECE 2010), Vancouver, British Columbia, Canada, November 12–18, 2010.

- [17] Moubarak, P., Ben-Tzvi, P., and Ma, Z., "A Generic Configuration of a Compact Dexterous and Self-Contained End-Effector for Mobile Robotic Platforms", Proceedings of the 2010 IEEE International Workshop on Robotic and Sensors Environments (ROSE 2010), Phoenix, Arizona, pp. 116–121, October 15-16, 2010.
- [16] Ben-Tzvi, P., Xu, X., "An Embedded Feature-Based Stereo Vision System for Autonomous Mobile Robots", Proceedings of the 2010 IEEE International Workshop on Robotic and Sensors Environments (ROSE 2010), Phoenix, Arizona, pp. 176–181, October 15-16, 2010.
- [15] Ben-Tzvi, P., Charifa, S., Shick, M., "Extraction of 3D Images Using Pitch-Actuated 2D Laser Range Finder for Robotic Vision", Proceedings of the 2010 IEEE International Workshop on Robotic and Sensors Environments (ROSE 2010), Phoenix, Arizona, pp. 140–145, October 15-16, 2010.
- [14] Zhou, Q., Ben-Tzvi, P., Iqbal, A., Fan, D., "Design, Analysis and Optimization of Magnetic Microactuators", Proceedings of the 2009 ASME Int'l Mechanical Engineering Congress and Exposition (IMECE 2009), Lake Buena Vista, Florida, pp. 503-512, Nov. 13-19, 2009.
- [13] Bai, S., Ben-Tzvi, P., Zhou, Q., Huang, X., "Fuzzy Sliding Mode Control of Flexible Spacecraft with Input Saturation", Proceedings of the 2009 ASME International Mechanical Engineering Congress and Exposition (IMECE 2009), Lake Buena Vista, Florida, pp. 1055-1061, November 13-19, 2009.
- [12] Ben-Tzvi, P., "Experimental Validation of a Hybrid Mobile Robot Mechanism with Interchangeable Locomotion and Manipulation", Proceedings of the 2009 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2009), St. Louis, Missouri, pp. 420–421, October 11–15, 2009.
- [11] Ben-Tzvi, P., "Wireless Modular Control Hardware Architecture for Hybrid Mechanism Mobile Robot", Proceedings of the 2009 ASME International Design Engineering Technical Conferences & Computers and Information in Engineering Conf. (IDETC/CIE 2009), 33rd Mechanisms & Robotics Conference, San Diego, CA, pp. 675–680, Aug. 30–Sep. 2, 2009.
- [10] Zhao, H., Ben-Tzvi, P., Tingqi Lin, T., Goldenberg, A.A., "Two-layer Sliding Mode Control of Pneumatic Position Synchro System with Feedback Linearization Based on Friction Compensation", Proceedings of the 2008 IEEE International Workshop on Robotic and Sensors Environments (ROSE 2008), Ottawa, ON, Canada, pp. 41–45, Oct 17–18, 2008.
- [9] Zhou, Q., Ben-Tzvi, P., Fan, D., Goldenberg, A.A., "Design of Fast Steering Mirror Systems for Precision Laser Beams Steering", Proceedings of the 2008 IEEE

International Workshop on Robotic and Sensors Environments (ROSE 2008), Ottawa, Ontario, Canada, pp. 144–149, October 17–18, 2008.

- [8] Bai, S., Ben-Tzvi, P., Zhou, Q., Huang, X., “Dynamic Modeling of a Rotating Beam Having a Tip Mass”, Proceedings of the 2008 IEEE International Workshop on Robotic and Sensors Environments (ROSE 2008), Ottawa, Ontario, Canada, pp. 52–57, October 17–18, 2008.
- [7] Ben-Tzvi, P., Goldenberg, A.A., and Zu, J.W., “Design, Simulations and Optimization of a Tracked Mobile Robot Manipulator with Hybrid Locomotion and Manipulation Capabilities”, Proceedings of the 2008 IEEE International Conference on Robotics and Automation (ICRA2008), Pasadena, California, pp. 2307–2312, May 19–23, 2008.
- [6] Ben-Tzvi, P., Goldenberg, A.A., “Mobile Robots for Hazardous Environments: New Technology for Mobility”, ANS 2nd Int. Joint Topical Meeting on Emergency Preparedness & Response and Robotic & Remote Systems (12th Robotics & Remote Systems for Hazardous Environments), Albuquerque, NM, Mar 9–12, 2008.
- [5] Raoufi, C., Ben-Tzvi, P., Goldenberg, A.A., and Kucharczyk, W., “A MR-Compatible Tele-Robotic System for MRI-Guided Intervention: System Overview and Mechanical Design”, Proceedings of the 2007 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS2007), San Diego, California, pp. 1975–1800, October 29 – Nov 2, 2007.
- [4] Ben-Tzvi, P., Goldenberg, A.A., and Zu, J.W., “Implementation of Sensors and Control Paradigm for a Hybrid Mobile Robot Manipulator for Search and Rescue Operations”, Proceedings of the 2007 IEEE International Workshop on Robotic and Sensors Environments (ROSE 2007), Ottawa, Ontario, Canada, pp. 92–97, October 12–13, 2007.  
\*\*\* Winner of the Best Student Paper Award \*\*\*
- [3] Ben-Tzvi, P., Ito, S., and Goldenberg, A.A., “Autonomous Stair Climbing with Reconfigurable Tracked Mobile Robot”, Proceedings of the 2007 IEEE International Workshop on Robotic and Sensors Environments (ROSE 2007), Ottawa, Canada, pp. 104–109, October 12–13, 2007.
- [2] Ben-Tzvi, P., Raoufi, C., Goldenberg, A.A., Zu, J.W., “Virtual Prototype Development and Simulations of a Tracked Hybrid Mobile Robot”, Proceedings of MSC Software 2007 Virtual Product Development Conference, Detroit, Michigan, October 10–12, 2007.
- [1] Ben-Tzvi, P., Goldenberg, A.A., Zu, J.W., “A Novel Control Architecture and Design of Hybrid Locomotion and Manipulation Tracked Mobile Robot”, Proceedings of the

2007 IEEE International Conference on Mechatronics and Automation (ICMA 2007), Harbin, China, pp. 1374–1381, August 5–8, 2007.

## **BOOKS**

[B1] Kurdila, A.J., Ben-Tzvi, P., Dynamics and Control of Robotic Systems. Wiley & Sons, Inc., December 2019, ISBN: 978-1-119-52483-0. (520 pages)

## **MONOGRAPHS**

[2] Ben-Tzvi, P., Hybrid Mobile Robot Systems: Symbiosis of Locomotion and Manipulation. Germany: LAP LAMBERT Academic Publishing, 2010 (ISBN-13: 978-3-8433-6890-2)

[1] Ben-Tzvi, P., A Dispensing System for Microdrops Generation in Medical Applications. Germany: LAP LAMBERT Academic Publishing, 2010 (ISBN-13: 978-3-8383-6000-3)

## **BOOK CHAPTERS**

[1] Ben-Tzvi, P., Moubarak, P., "A Mechatronic Perspective on Robotic Arms and End-Effectors" in Intelligent Mechatronics. Vienna, Austria: InTech Open Access Publisher, 28 Feb. 2011, pp. 3–20. (ISBN-13: 978-953-307-300-2, DOI: 10.5772/16234)

## PATENTS

- [20] Ben-Tzvi, P., Kamidi, V., “An Articulated Closed Kinematic Chain Planar Monopod”, U.S. Patent Application No. 17/813,772, Filed July 20, 2022. Published online November 24, 2022
- [19] Ben-Tzvi, P., Liu, Y., Rone, W.S., Saab, W., “Articulated Multi-Link Robotic Tail Systems and Methods”, U.S. Patent Application No. 17/697,353, Published June 30, 2022.
- [18] Ben-Tzvi, P., Njaka, T., Brizzolara, S., “High-Speed Omnidirectional Underwater Propulsion Mechanism”, U.S. Patent Application No. 17/531,007, Published December 8, 2022.
- [17] Ben-Tzvi, P., Refour, E., Sebastian, B., Xu, W., Guo, Y., Pradhan, S., “Robotic Exoskeleton Glove System”, U.S. Patent Application No. 16/888,993, Filed June 1, 2020.
- [16] Ben-Tzvi, P., Liu, Y., “Extensible Continuum Manipulator”, U.S. PCT Patent Application No. PCT/US2021/034564, Filed May 27, 2021.
- [15] Ben-Tzvi, P., Kamidi, V., “Articulated Closed Kinematic Chain Planar Monopod”, U.S. Patent No. 11,413,475, Issued August 16, 2022.
- [14] Ben-Tzvi, P., Liu, Y., Rone, W.S., Saab, W., “Articulated Multi-Link Robotic Tail Systems and Methods”, U.S. Patent 11,305,420, Issued April 19, 2022.
- [13] Ben-Tzvi, P., Kumar, A., “Linear Optical Sensor Arrays (LOSA) Tracking System for Active Marker Based 3D Motion Tracking”, U.S. Patent 10,295,651, Issued May 21, 2019.
- [12] Ben-Tzvi, P., Moubarak, P., “Active Docking Mechanism for Modular and Reconfigurable Robots”, U.S. Patent 9,616,948, Issued April 11, 2017.
- [11] Ben-Tzvi, P., Goldenberg, A.A., and Zu, J.W., “Hybrid Mobile Robot”, Canadian Patent No. CA2631116, Issued, September 2016.
- [10] Ben-Tzvi, P., Moubarak, P., “A mobile Robot with Hybrid Traction and Mobility Mechanism”, U.S. Patent 9,004,200, Issued April 14, 2015.
- [9] Ben-Tzvi, P., “A Mobile Robot with Symbiosis of Locomotion and Manipulation”, U.S. Patent 8,225,892, Issued July 24, 2012.
- [8] Ben-Tzvi, P., Goldenberg, A.A., and Zu, J.W., “Hybrid Mobile Robot”, U.S. Patent 7,874,386, Issued January 25, 2011.

- [7] Ben-Tzvi, P., Yang, J., Saab, W., "Robotic Modular Leg V2 Utilizing the Reuleaux Triangle Drive Mechanism to Build Legged Mobile Robots", U.S. Provisional Patent Application No. 62/855,968, June 1, 2019. (abandoned)
- [6] Ben-Tzvi, P., Williams, A., Sebastian, B., Kumar, A., Saab, W., "Semi-Autonomous Victim Extraction Robot (SAVER)", U.S. Provisional Patent Application No. 62/836,915, April 22, 2019. (abandoned)
- [5] Ben-Tzvi, P., Kumar, A., "An Expandable 6D Motion Tracking System Using Linear Optical Sensors Arrays (LOSA-X)", U.S. Patent Application No. 16/356,568, Filed March 18, 2019. (abandoned)
- [4] Ben-Tzvi, P., Saab, W., "Discrete Modular Serpentine Robotic Tail Mechanism for Mobile Legged Robots", U.S. Provisional Patent Application No. 62/340,140, May 23, 2016. (abandoned)
- [3] Ben-Tzvi, P., Saab, W., "Robotic Modular Leg Mechanism for Legged Mobile Robots", U.S. Provisional Patent Application No. 62/340,136, May 23, 2016. (abandoned)
- [2] Ben-Tzvi, P., "A Hybrid Suspension and Tension Mechanism for Mobile Robots", U.S. Patent Application No. 13/507,180, June 12, 2012. (abandoned)
- [1] Ben-Tzvi, P., "Mobile Robot with Symbiosis of Locomotion and Manipulation", U.S. Patent Application No. 12/925,145, October 14, 2010. (abandoned)

## **EXHIBIT 2**

**DR. PINHAS BEN-TZVI, PH.D., P.E., FASME, SMIEEE**

5503 Chestermill Ct

Fairfax, VA 22030

Tel: 202-641-8011

pinhas.bentzvi@gmail.com

## **Expert Testimony List**

### **United States District Court, Eastern District of Tennessee, Chattanooga Division**

Vincent Systems GmbH (Plaintiff) v. Fillauer Companies, Inc. and Motion Control, Inc.

(Defendant)\*, Civil Action No. 1:23-cv-00002-CEA-SKL, Patent Infringement Case Pertaining to US Patent 8,491,666

*Non-infringement, Invalidity*

### **United States District Court, Southern District of Ohio**

Stryker Corporation et al. (Plaintiff)\* v. Ferno-Washington, Inc. et al. (Defendant), Civil Action No. 1:22-cv-00588-MRB, Patent Infringement Case Pertaining to US Patents 7,398,571,

RE44,884, 7,725,968, 8,056,950; 10,058,464; D794,205; D833,623; D875,950; 11,090,207, and 10,568,787; 11,458,050

*Declaration to be prepared*

### **United States District Court, Southern District of Mississippi, Eastern Division**

Caspa Solutions LLC (Plaintiff)\* v. Howard Industries, Inc. (Defendant), Civil Action No. 2:22-cv-00065-HSO-BWR, Patent Infringement Case Pertaining to US Patents 7,594,668, 8,215,650, 8,109,527, D762,339, 9,039,016, 10,159,337, 10,299,582.

*Three Declarations*

### **United States International Trade Commission (ITC)**

In the Matter of Certain Electronic Candle Products and Components Thereof (Investigation No. 337-TA-1195)

L&L Candle Company LLC and Sotera Tschetter, Inc. (Complainants) v. Sterno Products *et al.* (Defendants)\*

*Provide expert opinion on patentability/obviousness*

### **United States District Court, District of Nebraska**

Hartford Fire Insurance Company (Plaintiff)\* v. McLeod Software Corporation (Defendant), Hartford Insurance Claim # CP0017674514, Court suit not yet filed

*Technical Report*

### **United States District Court, District of New Jersey**

IOTTIE INC. and HSM CO., LTD., (Plaintiffs)\* v. MERKURY INNOVATIONS (Defendant), Civil Action No. 2:15-cv-06597-KM-JBC (D.N.J.) Pertaining to US Patent 8,627,953

*Declaration, Deposition*

### **United States Patent and Trademark Office, Before the Patent Trial and Appeal Board**

Wagner Spray Tech (Plaintiff)\* v. Graco Inc. (MN) (Defendant); Not yet filed

Patent No. at Issue: 9,675,982

*Declaration, Provide expert opinion on patentability/obviousness*

**In the Court of Queen's Bench of Alberta, Canada**

DFI Corporation (Plaintiff)\* v. Sauer Danfoss, Inc. and Norcan Fluid Power Limited (Defendant),  
Court File Number 0903-16237

*Site Inspection/Field Investigation, Expert Report*

**United States International Trade Commission (ITC)**

In the Matter of Certain Hospital Beds and Components Thereof (Investigation No. 337-TA-987)  
Stryker (Complainant)\* v. Umano Medical Inc. and Umano Medical World Inc. (Defendants)

*Two Declarations, Deposition*

**United States Patent and Trademark Office, Before the Patent Trial and Appeal Board (IPR)**

SATA GmbH & CO. KG (Petitioner)\* v. ANEST IWATA CORPORATION (Patent Owner),  
Case No. IPR2013-00111 (Patent 6,494,387)

*Declaration, Deposition*

**In the Superior Court of the State of Delaware, In and For Sussex County**

Patrick Black (Plaintiff) v. Chromascape, Inc. dba Amerimulch; Lenze Americas Corp., Southtech  
Industries, Inc. (Defendant)\*, Civil Case No. S13C-04-018 RFS

*Site Inspection/Field Investigation, Expert Report*