

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.
Petitioner

v.

RESONANT SYSTEMS, INC.,
Patent Owner

Case IPR2024-00983
U.S. Patent No. 11,152,882

**PETITIONER'S REPLY
TO PATENT OWNER'S RESPONSE**

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LIST OF EXHIBITS

APPLE-1001	U.S. Patent No. 11,152,882 to Robin Elenga, et al. (“the ’882 Patent”)
APPLE-1002	Excerpts from the Prosecution History of the ’882 Patent (“the Prosecution History”)
APPLE-1003	Declaration of Dr. Blake Hannaford
APPLE-1004	RESERVED
APPLE-1005	U.S. Patent Publication No. 2013/0237751 (“Alexander”)
APPLE-1006	U.S. Patent Publication No. 2008/0246532 (“Cosper”)
APPLE-1007	U.S. Patent No. 7,843,277 (“Gregorio”)
APPLE-1008	U.S. Patent Publication No. 2008/0001484 (“Fuller”)
APPLE-1009	U.S. Patent No. 5,952,806 (“Muramatsu”)
APPLE-1010	U.S. Patent Application Publication No. 2008/0294984 to Erin B. Ramsay, et al. (“Ramsay”)
APPLE-1011	Resonant Systems Proposed Claim Constructions, 7-23-cv-00077 (WDTX) (Feb. 15, 2024)
APPLE-1012	Apple, Inc. Proposed Claim Constructions, 7-23-cv-00077 (WDTX) (Feb. 15, 2024)
APPLE-1013	Apple, Inc. Opening Claim Construction Brief, 7-23-cv-00077 (WDTX) (March 21, 2024)
APPLE-1014	U.S. Patent No. 7,005,811 (“Wakuda”)

APPLE-1015	Resonant Systems Infringement Contentions, '882 Patent, 7-23-cv-00077 (WDTX)
APPLE-1016	Resonant Systems, Inc's Responsive Claim Construction Brief, 7-23-cv-00077 (WDTX) (April 11, 2024)
APPLE-1017	Stipulation dated September 18, 2024
APPLE-1018	Second Declaration of Dr. Hannaford
APPLE-1019	Transcript of May 9 Deposition of Dr. Keith Goossen
APPLE-1020	Transcript of May 7 Deposition of Dr. Keith Goossen

I. INTRODUCTION

Patent Owner fails to identify any meaningful deficiencies in the Petition, not disputing that the Alexander Ground (Ground 1) provides each and every limitation of all challenged claims, or that the Gregorio Grounds (2A-2H) provide each element of the claims except steps 4519 and 4520 of the “control component.” Patent Owner’s analysis of the Alexander Ground alleges only that a POSITA would not have combined Alexander and Cosper. But Patent Owner’s assertion that “Alexander and Cosper are not analogous art” mischaracterizes the references and ignores both the overlapping technical fields and the similar problems addressed by the references. Likewise, Patent Owner’s assertions regarding Gregorio mischaracterize both the Petition and Gregorio. Patent Owner’s theories fail to undermine the combinations. The claims of the ’882 Patent were simply not new in view of the prior art, and thus are unpatentable. APPLE-1018, ¶4.

II. THE ALEXANDER-COSPER GROUND RENDERS OBVIOUS ALL CHALLENGED CLAIMS

Patent Owner cannot contest that all elements of the claims were in the prior art. Patent Owner instead focuses on the motivation to combine Alexander with Cosper, alleging they are not analogous art to the ’882 Patent and would not have been combined. In doing so, Patent Owner fails to address the common technical

field, problems, objectives, and end-use devices that are shared with the '882 Patent, and never mentions that the Examiner applied Alexander in a rejection during original prosecution of the '882 Patent. Moreover, the POR ignores the motivations set forth in the Petition that would have prompted a POSITA to combine Alexander and Cosper. A POSITA would have recognized the benefits of implementing Alexander's linear actuator in accordance with Cosper's techniques of multiple sensors and feedback control in linear oscillating systems, with a reasonable expectation of success. *See, e.g.,* Pet., 11-168; APPLE-1018, ¶6.

A. Alexander and Cosper are analogous art to the '882 Patent

Patent Owner's assertion that "Alexander and Cosper are not analogous art" is based on legal and factual errors. In evaluating whether a reference is analogous, the required comparison is between the reference and the patent at issue. *See, e.g., Donner Tech., LLC v. Pro Stage Gear, LLC*, 979 F.3d 1353, 1359 (Fed. Cir. 2020) (comparing the challenged patent with the prior art reference when considering whether analogous); *In re Bigio*, 381 F.3d 1320, 1325 (Fed. Cir. 2004). Here, each reference is within the same field as, and reasonably pertinent to problems set forth by, the '882 Patent. APPLE-1018, ¶¶6-7.

1. Alexander is in the "same field of endeavor" as the '882 Patent.

The '882 Patent expressly describes its "Technical Field" as "related to vibration-generating devices and, in particular, to vibration modules that can be

incorporated into a wide variety of different types of electromechanical devices and systems to produce predetermined vibration responses.” APPLE-1001, 1:11-16; Institution Decision, 3. Alexander falls within this field of endeavor. APPLE-1018, ¶8; *see Unwired Planet, LLC v. Google Inc.*, 841 F.3d 995, 1001 (Fed. Cir. 2016).

Like the ’882 Patent, Alexander describes vibration-generating devices, including in the form of a “linear actuator” having a mover and a stator, and a “controller operable to control the relative motion between said stator and mover” to produce predetermined vibration responses (e.g., “motion profiles.”). APPLE-1005, Abstract, [0037], [0056], cl. 4 (“predetermined”); Pet., 9-10, 23-30; APPLE-1018, ¶9. And like the ’882 Patent, the “linear actuators” described by Alexander can be implemented for incorporation into various electromechanical devices. APPLE-1001, Abstract; APPLE-1005 (“As a non-limiting example, one possible embodiment”); Institution Decision, 3-4. Indeed, independent claims 1 and 4 of Alexander broadly recite a “linear actuator” (cl. 1) and “method of controlling the motion of a linear actuator” (cl. 4) without limitation as to the types of devices into which the linear actuator is incorporated. APPLE-1005, cls. 1-6.

Tellingly, the overlap between Alexander and the ’882 Patent extends to specific use applications of actuator products—the ’882 Patent and Alexander both describe vibrating products for human physical interaction. Alexander describes

an example use for its linear actuator in a “handheld unit” (e.g., “sexual appliance”), and the ’882 Patent likewise describes devices having an “external massage arm” that provides a “linearly oscillating massage-foot member” for “massaging human skin.” APPLE-1009, Abstract; APPLE-1001, 8:4-19, 12:12-36, FIGS. 17-19; Pet., 38; APPLE-1018, ¶10. Patent Owner never addresses, much less challenges, this overlap that demonstrates Alexander is in the same field of endeavor as the ’882 Patent.

2. Alexander is “reasonably pertinent” to the problems identified in the ’882 Patent.

In addition to being in the same field of endeavor, which independently demonstrates Alexander is analogous art to the ’882 Patent, Alexander is pertinent to the same problems identified by the ’882 Patent.

The ’882 patent describes objectives of “more efficient and capable vibration-generating units for incorporation into many consumer appliances, devices, and system,” and the problems achieving these objectives using prior art “unbalanced electric motors.” APPLE-1001, 1:29-3:2 (problems of “destructive, unbalanced forces,” “relatively inefficient,” “elliptical” vibrational modes, and “only a very limited portion of the total vibrational-force/frequency space” is accessible); APPLE-1018, ¶11.

As an initial matter, the pertinence of Alexander’s teachings is highlighted

by the fact that Alexander was identified by the Examiner and applied in a rejection during original prosecution of the '882 Patent. Pet., 72-75. Not only is Alexander the type of reference a POSITA would have found reasonably pertinent to the problems of the '882 patent (as described in more detail below), but the Patent Office itself identified and applied Alexander as such during prosecution. APPLE-1002, 145-179; Pet., 72-75. Simply put, this is not a case of a Petitioner selectively picking disparate references in hindsight in an attempt to recreate the claims—Alexander was pertinent both during original prosecution and in the present proceeding due to its teachings relevant to the features recited by the '882 Patent, all of which were known. APPLE-1018, ¶12.

In response to the Examiner's rejection based on Alexander, Applicant did not allege that Alexander was non-analogous when originally prosecuting the '882 patent. *See, e.g.*, APPLE-1002, 145-179. And now, in alleging that Alexander is purportedly non-analogous to the '882 Patent, Patent Owner ignores Alexander's presence in the prosecution history.

In more detail, Alexander's teachings are pertinent to the objectives of producing predetermined vibration responses in vibration modules, and to shortcomings of unbalanced electric motors, that the '882 Patent recites. APPLE-1018, ¶12. Like the '882 patent, Alexander generates motion profiles in the context of oscillating linear and curvilinear actuators. APPLE-1005, [0022]. And

Alexander describes specific techniques and configurations that address such problems, including feedback control techniques and the use of multiple sensors to characterize and generate oscillation according to predetermined profiles. APPLE-1005, [0034]-[0035] (“A feedback control system is used to control the position and motion of the mover,” and “allows precise control of the position of the tube.”), [0035], [0037] (“Using feedback control of the mover position, a variety of position and motion parameters of the linear motor can be controlled by the control system, including: mover stroke, mover speed, and mover acceleration.”), [0039]; APPLE-1001 (“The CPU receives input 730 from 30 one or more electromechanical sensors 732 that generate a signal corresponding to the strength of vibration currently being produced by the linearly oscillating mass 734.”).

Even the type of oscillation described by Alexander aligns with the ’882 Patent—both describe sinusoidal output. *Compare* APPLE-1005, [0037] (“sine wave motion”) and [0055] (“fast sinusoidal stroke”) *with* APPLE-1001, 24:47-48 (“The desired vibration response of the ORM is a sine-wave-like 3702 oscillation. . .”), 25:24 (“achieve the sine-wave-like vibration response”); APPLE-1018, ¶13.

And, as noted above, both Alexander and the ’882 patent describe applications involving direct physical contact—both address problems common to generating vibration suitable to massage human skin. APPLE-1009, Abstract; APPLE-1001, 12:12-36, FIGS. 17-19; APPLE-1018, ¶14.

3. Cosper is in the “same field of endeavor” as the ’882 Patent.

Cosper is also within the same field as the ’882 Patent. Cosper broadly “relates to systems and methods for control of a mass and bias (e.g., ‘elastomeric members’) subassembly, including oscillating mechanical systems, that operate in an oscillatory mode at or near their mechanical resonant frequency.” APPLE-1009, [0003], [0012]. Notably, Cosper expressly indicates that “[a]ny appropriate subassembly may be used with the systems and methods described herein.” *Id.*; APPLE-1018, ¶15.

The straightforward analysis of the Petition is not undermined by Patent Owner’s assertion that Cosper’s field of endeavor and problems addressed “have nothing to do with Alexander’s,” and that “Cosper is not about linear motors at all, and Alexander is not about resonant motors at all.” POR, 16. Even if Patent Owner’s assertion accurately reflected Alexander and Cosper (which it does not, as described above), differences between two references do not preclude the art from being analogous where they are reasonably pertinent to the problems identified by the challenged patent. *See, e.g., In re ICON Health & Fitness, Inc.*, 496 F.3d 1374, 1380 (Fed. Cir. 2007) (concluding that ‘[a]nalogous art to Icon’s application,’ which related to ‘a treadmill with a folding mechanism and a means for retaining that mechanism in the folded position,’ included ‘any area describing hinges, springs, latches, counterweights, or other similar mechanisms—such as the folding

bed in’ the prior art); *Donner Tech.*, 979 F.3d at 1361 (“Indeed, there will frequently be significant differences between a patent and a reference from a different field of endeavor. But it does not follow that such a reference is, for that reason alone, not reasonably pertinent to one or more problems to which the claimed invention relates.”); APPLE-1018, ¶16.

The POR asserts that “the two embodiments shown [in Cosper] describe rotational motion of the moving mass.” POR, 15. However, Patent Owner’s declarant acknowledged this statement referred only to embodiments in FIG. 2 and FIG. 15, and not Cosper’s discussion of FIG. 1, which is identified in the Petition. APPLE-1020, 15:13-19, 19:14-20:13. More importantly, Patent Owner’s Response ignores much of Cosper’s actual teachings that are not limited to rotational motion or optical beam scanner devices. Indeed, as explained in the Petition, Cosper expressly discloses linear motion and linear actuators/motors. APPLE-1006, [0047]-[0057] (“linear” mode of movement); FIG. 1 (illustrating “linear” oscillation of subassembly); APPLE-1005, [0022] (the terms ‘motor’ and ‘actuator’ may be used interchangeably”); APPLE-1018, ¶17.

4. Cosper is “reasonably pertinent” to the problems identified in the ’882 Patent.

Cosper is likewise pertinent to the problems recited by the ’882 Patent, describing feedback control techniques that promote “efficient” oscillation and that

provide vibration modes beyond “elliptical” vibration (i.e., rotational oscillation), including “linear” oscillation. APPLE-1018, ¶18 (citing APPLE-1006, [0005]-[0013], [0048]-[0057], [0067]). Cosper describes sensor techniques for monitoring oscillation of the moveable mass, and feedback control to promote oscillation according to particular characteristics (e.g., at a resonant frequency), facilitating enhanced vibration output and promoting efficient operation. *Id.* Moreover, Cosper expressly describes and illustrates linear oscillation. *See, e.g.*, APPLE-1009, FIG. 1; APPLE-1050, 14:18-15:19. Cosper’s teachings were plainly pertinent to the problems recited by the ’882 Patent and are analogous art for this additional reason.

B. A POSITA would have been motivated to apply Cosper’s teachings of feedback control when implementing a handheld device consistent with Alexander

The Petition sets forth multiple straightforward motivations which are expressly supported by Cosper’s stated benefits and advantages. Pet., 11-17. The fulsome analysis set forth in the Petition is not undermined by Patent Owner’s assertions, which amount to strawman arguments that mischaracterize the combination and ignore Alexander’s teachings of embodiments having varied structures and characteristics. APPLE-1018, ¶19.

1. A POSITA would have been motivated to combine Alexander and Cosper to enhance vibration output.

As set forth in the Petition and Dr. Hannaford's testimony, multiple reasons would have motivated a POSITA to combine Alexander and Cosper. Pet., 11-16. First, Patent Owner never specifically disputes that "a POSITA would have been led to combine Alexander and Cosper to effectively implement position sensors for feedback control, enhancing Alexander's stated objectives of improving precision of oscillation output by implementing effective position sensing for feedback control." Pet., 14-15. This rationale remains uncontroverted and provides an independent reason why a POSITA would have been motivated to combine Alexander and Cosper. APPLE-1018, ¶20.

Second, the Petition further highlights that a POSITA would have been motivated to implement feedback control to maintain oscillation near a resonant frequency, which would have predictably facilitated efficient operation of Alexander's device, and would have promoted effective operational runtime, and/or facilitated maximum magnitude with reduced input when operating in the resonant condition, thereby enhancing user satisfaction. Pet., 13-14. Indeed, a POSITA would have recognized the benefits of efficient resonant operation, which promote operation at a given amplitude or velocity while facilitating a lighter weight and/or more compact design. APPLE-1018, ¶21. Here again, the POR never specifically disputes these benefits of the combination. POR, 18-24; APPLE-1018, ¶21.

Patent Owner alleges that neither “Petitioner nor its expert Dr. Hannaford cites to anything **in Alexander** that shows this would be beneficial.” POR, 18 (emphasis added). But, in fact, the Petition highlights Alexander’s teachings of a “handheld” device that is powered by a “battery.” APPLE-1005, Abstract, [0021]-[0025], [0052]. Accordingly, a POSITA would have readily recognized the desirability of generating a desired amplitude/velocity for a given input in such a battery-powered device. APPLE-1018, ¶22. Additionally, the straightforward motivations are supported, for example, by the express teachings of Cosper and testimony evidence—the motivations need not be found only in the primary reference. APPLE-1006, [0005]-[0006] (“desirable to move and control a mechanical system at or near its resonant frequency to achieve the maximum system movement for a reduced or minimal amount of energy.”); *Outdry Techs. Corp. v. Geox S.p.A.*, 859 F.3d 1364, 1370-1371 (Fed. Cir., 2017) (“Any motivation to combine references, whether articulated in the references themselves or supported by evidence of the knowledge of a skilled artisan, is sufficient to combine those references to arrive at the claimed process.”).

2. A POSITA would have implemented the Alexander-Cosper combination with a reasonable expectation of success.

The remaining assertions in the POR amount to strawman arguments that mischaracterize Alexander and the combination, and are premised on bodily

incorporation of particular structures. Patent Owner's myopic focus on discrete operating scenarios ignores that Alexander describes a variety of structures and operating profiles for different preferences and use cases, of which the benefits articulated in the Petition would have been readily recognized by a POSITA. APPLE-1018, ¶23.

A POSITA is not a mindless automaton, and would have readily selected dimensions and operating configurations to attain the recognized benefits of resonance for one or more appropriate frequencies/stroke lengths, without hindering the ability of the device to output a range of motion profiles selected by the user. Nonetheless, Patent Owner erroneously assumes otherwise, addressing a scenario in which resonance would occur at 1 Hz and at a six-inch stroke length using a "square wave" pattern. POR, 18-21. The POSITA was not so limited. *Intel Corp. v. PACT XPP Schweiz AG*, 61 F. 4th 1373, 1379-80 (Fed. Cir. 2023) ("a person of ordinary creativity, not an automaton").

For example, Alexander discloses varied structural configurations and geometries, expressly enumerating configurations that have only "one magnet" or multiple magnets (e.g., six magnets), and indicates that the "spacing and orientations of the magnets may vary based on the design." APPLE-1005, [0023], [0025]-[0026]. Alexander describes a configuration in which a magnet "phase" (including "a magnet-spacer-magnet-spacer set") has a length of two inches, and

three magnet phases are provided to facilitate a six-inch stroke. Where only “one magnet” is used (APPLE-1005, [0023]), the stroke length would be shorter (e.g., as short as an inch or less). APPLE-1018, ¶24.

Patent Owner’s arguments are based on isolated examples of Alexander that ignores these shorter configurations that use just “one magnet,” for example. POR, 18-21. Indeed, Patent Owner’s Declarant acknowledged that he never considered these teachings of Alexander. APPLE-1019, 37:22-40:1 (“Q. And so, for example, you didn’t consider a configuration of Alexander that used a single magnet, for example? A. It was not necessary for my analysis.”); *see also* 38:5-9 (“My analysis of this art was specific to whether it is a resonant system, and my opinion is that it is not a resonant system. And any other analysis is outside this scope of my report.”); APPLE-1019, 44:21-3. Patent Owner’s assertions fail to demonstrate any incompatibility between Alexander and a resonant design in the combined system, especially where Patent Owner and its expert did not even consider Alexander’s full teachings relied upon for the combination.

As explained by Dr. Hannaford, a POSITA would have readily implemented Cosper’s teachings in Alexander according to parameters desired for a particular application. As one example, a POSITA would have readily configured the combined system to provide resonant operation at a stroke length near the middle of a maximum stroke length. *Id.* Such a configuration would have predictably

achieved the benefits of enhanced output and power-efficiency. *Id.* This is especially the case in a scenario in which the device is operated at resonance for a meaningful duration. APPLE-1018, ¶25. And such a configuration would avail the user of an additional motion profile to choose from to provide extended runtime on a single charge. APPLE-1018, ¶25. Indeed, a POSITA would have recognized this overall efficient operation. *Id.*

For similar reasons, a POSITA would have had a reasonable expectation of success in implementing the Alexander-Cosper combination, which was within the basic skills of a POSITA. APPLE-1018, ¶26. Patent Owner alleges that “Dr. Hannaford **states without evidence** that ‘the bias member would have been readily selected with characteristics to facilitate operation at a resonant frequency over at least a portion of the mover’s stroke.’” POR, 20 (emphasis added). In doing so, Patent Owner conspicuously ignores the multiple corroborating references cited by the Petition and Dr. Hannaford on this point—including Gregorio, Fuller, and Wakuda—which further confirm such modification would have been a matter of routine implementation for a POSITA prior to the time of the ’882 Patent. Pet., 16 (citing Gregorio (APPLE-1007), Fuller (APPLE-1008), Wakuda (APPLE-1014); Pet., 16 (citing APPLE-1007, 3:12-28, FIG. 2; APPLE-1008, [0007], [0025], [0048]-[0050], FIGS. 8-9; APPLE-1014, 2:29-54, 3:64-4:5, 5:25-50, 7:26-30, FIGS. 1A-1B); APPLE-1003, ¶¶76-77.

Selecting a bias member and packaging it in a housing such as Alexander's was not new, and a POSITA would have readily configured the bias member to accommodate a range of operating profiles, consistent with Alexander's objectives, such as by selecting a bias member to promote resonance when operating near a middle of a maximum stroke length. APPLE-1018, ¶26.

The combination is likewise not undermined by Patent Owner's assertions that Petitioner "cannot explain any context in which it would be desirable or safe to operate a sex toy with a stroke length of several inches at a frequency substantially above 1 Hz." POR, 20. Nothing in Alexander limits operation to 1 Hz, and a POSITA would have recognized use of other frequencies. APPLE-1018, ¶27 (citing APPLE-1005, [0037]-[0039]). Patent Owner cites the '882 Patent as disclosing frequencies "even above 350 Hz,"¹ but the combination does not require operation at 350 Hz or any other heightened frequency. *Intel*, 61 F. 4th at 1379-80.

¹ To be clear, even the '882 Patent itself describes operation of resonant modules at significantly lower frequencies. *See* APPLE-1001, FIG. 10; APPLE-1019, 19:13-17 ("Q. And so for this particular curve the, at say 20 Hertz, there is a particular amplitude output that is relatively high if we are looking at the curve 1004?" A. Yes.").

Ultimately, a POSITA would have been motivated to combine Alexander and Cosper to achieve straightforward benefits, without detrimentally hindering Alexander's existing functionality. APPLE-1018, ¶28.

III. THE GREGORIO GROUNDS RENDER OBVIOUS STEPS 4519 AND 4520 OF THE “CONTROL COMPONENT”

Patent Owner does not dispute that the Gregorio Grounds (2A-2H) render obvious all limitations [1pre]-[1c] and [10pre]-[10e] of independent claims 1 and 10. Patent Owner focuses solely on isolated aspects of Limitation [1d] and [10f], arguing that the Petition did not address how the Gregorio grounds disclose “computing the control based upon target frequency and current position and velocity.” POR, 24-30. But Patent Owner mischaracterizes the analysis of these elements set forth in the Petition. APPLE-1018, ¶29.

A. The Gregorio Grounds render obvious steps 4519 and 4520 (Grounds 2A-2D)

Gregorio renders obvious step 4519 (“control logic reads the position and velocity data from the sensor”) and step 4520 (“the appropriate control is computed based on the target frequency ω_t and the current position and velocity of the moving mass p and v ”). For example, as set forth in the Petition's analysis of element [1d], the Petition expressly addressed that Gregorio's control component receives outputs from the one or more sensors when Gregorio's sensed position signals are received by its control component as outputs of its sensing device(s)

(e.g., a Hall sensor). Pet., 47-48; APPLE-1003, ¶177. Gregorio's control component reads/derives position and velocity data from the sensor(s) (step 4519). Pet., 48; APPLE-1018, ¶30.

Additionally, Gregorio's determined resonant frequency provides a "target frequency," and the control component provides control signals computed based on the target frequency ω_t (e.g., a determined resonance frequency) and the current position (e.g., sensed by the Hall sensor) and velocity (speed) of the moving mass (step 4520). APPLE-1018, ¶31; Pet., 46-49. Indeed, Gregorio expressly indicates the drive signal is "adjusted to maximize the haptic feedback **based on** the determined resonant frequency," further confirming that appropriate control is computed based on the target frequency ω_t . APPLE-1007, 2:3-9 (emphasis added).

Patent Owner faults the Petition as showing only "that a POSITA could have determined velocity from the position data, not that the POSITA would have been motivated to do this." POR, 27. Not so. The Petition provided multiple reasons why a POSITA would have derived velocity from the position data and based its control calculations on this information. Pet., 47-49; APPLE-1018, ¶32.

As set forth in the Petition, a POSITA would have found obvious, especially in view of Gregorio's description of determining the "derivative of the speed of the mass ('dv/dt')," that computing velocity from position beneficially provided the controller with additional information relevant to the current motion of the

movable mass, and further facilitated determination of acceleration (dv/dt). Pet., 48. For example, the velocity information would have facilitated enhanced characterization of the movement of the mass accurately and in real-time by detecting the change in position over time, furthering Gregorio's objective of detecting and controlling to achieve oscillation at a resonant frequency. APPLE-1018, ¶33; Pet., 48-49; APPLE-1019, 29:4-15.

A POSITA would have also recognized the signal processing advantages associated with derivation of velocity from the position signal, providing enhanced detection of change in direction, transitions in velocity, etc. APPLE-1018, ¶¶34-35. Relatedly, a POSITA would have recognized the mathematical fundamentals of a derivative of position that can result in a signal having a sharper peak, further facilitating signal processing and characterization of the movement of the mass and associated determination of the resonant frequency. *Id.* Relatedly, a POSITA would have recognized the benefits of using a derivative of the speed of the mass as an indicator of "how far the mass will rise above the zero crossing," which can be determined at various points, separate from a measurement of a particular max position. *Id.*

The Petition's analysis is not undermined by Patent Owner's proposal that "a POSITA desiring to measure amplitude using a position sensor would do so by comparing position measurements directly, rather than by deriving velocity from

position measurements and then taking a derivative of the derived velocity.” POR, 26-27. Even if Patent Owner’s proposal were viable (which is not mentioned by Gregorio’s express text, and unsupported by any documentary evidence from Patent Owner), it does not render the conventional technique of calculating dv/dt any less obvious. This is especially the case where deriving velocity and acceleration from position was ubiquitous, and Gregorio itself provides an example of using acceleration (e.g., “ dv/dt ”) in calculating “how far the mass will rise above the zero crossing.” APPLE-1007, 4:42-48. As set forth in the Petition and above, a POSITA would have recognized the benefits of such a technique, and no further modification of Gregorio is required by the Petition’s analysis. APPLE-1018, ¶36.

Even beyond the known benefits discussed above, a POSITA would have recognized derivation of velocity and acceleration as a “suitable” option to effectuate Gregorio’s objective to oscillate at a resonant frequency. *Intel Corporation v. PACT XPP Schweiz AG*, 61 F.4th 1373, 1381 (Fed. Cir. March 13, 2023) (reversing Board and finding Petitioner just had to show feature was a “suitable” option). That is enough and provides an independent reason why Gregorio renders obvious steps 4519 and 4520.

To be clear, Patent Owner’s assertion that the “petition provides no evidence that Gregorio suggests using both position sensing and back-EMF speed sensing in

the same system or that a POSITA would have been motivated to modify Gregorio's embodiments in order to do this" does not undermine the Petition's analysis, because this is not the analysis set forth in the Petition. The Petition never calls for "both position sensing and back-EMF speed sensing in the same system." Thus, Patent Owner's assertion is not responsive to the Petition's actual analysis. APPLE-1018, ¶37.

B. Gregorio in view of Muramatsu renders obvious steps 4519 and 4520 (Grounds 2E-2H)

The Gregorio Grounds render obvious steps 4519 and 4520 as described above. Additionally, steps 4519 and 4520 are rendered obvious further in view of Muramatsu. APPLE-1018, ¶38.

As set forth in the Petition, Muramatsu discloses conventional techniques of computing control outputs from position and/or velocity of a moving object and using pre-computed values in lookup tables. Pet., 65-68 (citing "calculates a current velocity X' on the basis of the current position X and the previous position." APPLE-1009, 6:23-27; APPLE-1018, ¶39.

Patent Owner never disputes the motivations set forth in the Ground 2E/2F analysis, including that a POSITA would have recognized the use of position measurements at multiple (e.g., two) points as a conventional and reliable technique for determining velocity, and facilitating effective characterization of the

motion of Gregorio's moveable magnet(s) for use in the feedback control system.

IV. CONCLUSION

Petitioner has established that the Challenged Claims are unpatentable and respectfully requests that the Board find the same.

Respectfully submitted,

Date: June 3, 2025

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CERTIFICATION UNDER 37 C.F.R. § 42.24

Under the provisions of 37 CFR § 42.24(d), the undersigned hereby certifies that the word count for the foregoing Petitioner Reply to Patent Owner Response totals 4,325 words, which is less than the 5,600 allowed under 37 CFR § 42.24(c)(1).

Respectfully submitted,

Date: June 3, 2025

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CERTIFICATE OF SERVICE

Pursuant to 37 CFR § 42.6(e)(4), the undersigned certifies that on June 3, 2025, a complete and entire copy of this Petitioner's Reply to Patent Owner's Response was provided by email to Patent Owner by serving the email correspondence addresses of record as follows:

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