

Reply Declaration of Darrin Young in Support of
Petition for *Inter Partes* Review of
U.S. Patent No. 6,508,122 B1

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

NINTENDO CO., LTD., and
NINTENDO OF AMERICA INC.,
Petitioners

v.

AMERICAN GNC CORPORATION,
Patent Owner.

Case IPR 2024-00667
U.S. Patent No. 6,508,122 B1

REPLY DECLARATION OF DARRIN YOUNG, PH.D.

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I, Darrin Young, declare as follows:

I. INTRODUCTION

1. My name is Darrin Young. I have prepared this declaration as an expert witness on behalf of Petitioner Nintendo Co., Ltd., and Nintendo of America Inc. In this declaration, I will provide my opinions regarding the invalidity of claims 1 and 3 (the “challenged claims”) of U.S. Patent No. 6,508,122 (the “’122 patent”; **EX1001**) in response to Dr. Lawrence Larson’s declaration (**EX2019**) and Mr. Hiram McCall’s declaration (**EX2023**). I also provide herein the technical bases for these opinions, as appropriate.

2. Along with my March 7, 2024 declaration (**EX1002**; “opening declaration”), this declaration contains statements of my opinions formed to date, and the bases and rationale for these opinions. I may offer additional opinions based on further review of materials in this case, including opinions and/or testimony of other expert witnesses.

3. For my efforts in connection with the preparation of this declaration, I have been compensated at my usual and customary rate for this type of consulting activity. My compensation is in no way contingent on the results of these or any other proceedings related to the ’122 patent.

II. BACKGROUND

4. I discussed my professional qualifications in my opening declaration and provided my resume. (EX1002, ¶¶ 4-10, Appx. A.) I provide the following additional remarks regarding my background in response to Patent Owner and its expert's arguments regarding my background.

5. I started my research work in MEMS as a graduate research student at the University of California at Berkeley between 1993 and 1994. I worked on design and simulation of a Sigma-Delta modulator architecture to interface with a capacitive MEMS accelerator. The Sigma-Delta architecture produces a one-bit digital output, which can be used to provide a digital force feedback signal to control the position of a MEMS accelerometer's proof mass at its nominal position. The one-bit digital force feedback signal further helps achieve a linear system performance. The Sigma-Delta architecture suppresses the quantization noise in the low-frequency region, where an incoming acceleration signal typically resides, thus achieving an improved signal-to-noise ratio (SNR). I also applied a digital decimation filter to the one-bit digital output to determine the incoming acceleration signal amplitude and the minimum detectable signal level. After this project, I worked on design and development of MEMS fabrication technology for fabricating surface-micromachined capacitive MEMS structures that can be used as a voltage-

controlled, tunable capacitor or a capacitive sensor to detect acceleration or vibration. I also worked on design and fabrication of an on-chip 3D coil inductor for building a MEMS-based low noise radio-frequency voltage-controlled oscillator.

6. After I received my Ph.D. degree in 1999, I joined Case Western Reserve University as an assistant professor in the Electrical Engineering Department, where I continued my MEMS research work. During my tenure there between 1999 and 2009, I designed and fabricated MEMS sensors, including accelerometers, gyroscopes, resonators, strain sensors, pressure sensors, and mixed-signal sensor interface integrated circuits. The sensor interface integrated circuits employed building blocks including low noise capacitance-to-voltage converter, capacitive pick-off circuitry, mixers, filters, reference circuits, clock generators, analog-to-digital converters, digital logic control circuits, digital encoders, etc. I also designed and implemented a fully integrated MEMS accelerometer with CMOS integrated circuits on a same chip. I worked on digital signal processing on output signals from Sigma-Delta modulator-based analog-to-digital converters using digital decimation filters to determine the analog signal amplitude at the input of the modulator. These MEMS sensors, sensor-interface circuits, and digital signal processing steps were applied to different applications including biomedical implant, motion detection, strain sensing, and personal navigation.

III. RESPONSE TO DR. LARSON

7. I have reviewed Dr. Larson’s Declaration (EX2019) and provide the following opinions and analysis in response.

A. Response to Dr. Larson’s Opinions re Person of Ordinary Skill in the Art and State of the Art of MEMS Inertial Sensors

8. As I discussed in my opening declaration, it is my opinion that a person of ordinary skill would have possessed a bachelor’s degree in electrical engineering or similar degree, with two to three years of practical experience designing and/or implementing systems that include sensors for measuring movement, such as acceleration and rotational position. (EX1002, ¶ 14.)

9. Dr. Larson indicates that a person of ordinary skill “would have at least a Master’s Degree in Electrical or Electronics Engineering, and approximately five years of relevant experience in the development of control systems for inertial navigation, MEMS semiconductor processing, and analog circuit design—with additional education substituting for experience and vice versa.” (EX2019, ¶ 57.) While I proposed a different definition of a person of ordinary skill, I do not disagree with Dr. Larson’s proposed definition. My opinions regarding the obviousness of the ’122 patent challenged claims over the prior art, moreover, remain the same under either formulation.

10. In connection with his definition of a person of ordinary skill, Dr. Larson makes various statements with which I disagree. Dr. Larson opines that at the time of the '122 patent, “the technological development of this field – MEMS inertial sensors – was still in its early research stages.” (EX2019, ¶ 57.) Furthermore, Dr. Larson opines that “there was no established industry or large body of academic work in MEMS devices[.]” (*Id.*, ¶ 58.) I disagree with these assertions. The field of MEMS inertial sensors was at least a decade old by the time of the claimed priority date of the '122 patent and was well-established. Commercially-available products containing MEMS inertial sensors were available and numerous research teams (including my own) had been working on MEMS research for years. Accordingly, in my opinion, MEMS was far more developed than its “early research stages” as Dr. Larson contends, and there was an established industry and large body of academic work in MEMS devices, including MEMS inertial sensors.

11. My own experience with MEMS inertial sensors (discussed above) indicates that the technological development of MEMS inertial sensors was more developed than Dr. Larson asserts. For example, I started working with MEMS inertial sensors as early as 1993—six years before the claimed 1999 priority date of the '122 patent. By the time of the '122 patent, the field had significantly advanced even from when I first started working with MEMS inertial sensors.

12. My views are supported by other evidence in the record. For instance, the inventor of the '122 patent, Mr. Hiram McCall, indicates in his declaration (EX2023) that Draper Labs was developing MEMS inertial sensors around the time of the '122 patent. (EX2023, ¶ 22.) Indeed, the Draper Labs was the assignee of U.S. Patent No. 5,349,855 to Jonathan J. Bernstein and Marc S. Weinberg directed to a MEMS inertial sensor, whose filing date predated the claimed priority date of the '122 patent by almost seven years. (EX1055.)

13. AGNC's own patent specification states the field of MEMS inertial sensors was far more developed than Dr. Larson's characterization—*i.e.*, that it was in its "early research stages." (EX2019, ¶ 57.) For example, the '122 patent indicates that:

Various MEMS angular rate sensor approaches have been developed to meet the need for inexpensive yet reliable angular rate sensors in fields ranging from automotive to consumer electronics. Single input axis MEMS angular rate sensors are based on either translational resonance, such as tuning forks, or structural mode resonance, such as vibrating rings. Moreover, dual input axis MEMS angular rate sensors may be based on angular resonance of a rotating rigid rotor suspended by torsional springs. The inherent symmetry of the circular design allows angular rate measurement about two axes simultaneously.

(EX1001 ('122 patent), 1:57-67 (emphasis added).) Further, the '122 patent indicates that “[e]xample MEMS devices include inkjet-printer cartridges, **accelerometers that deploy car airbags**, and miniature robots.” (*Id.*, 1:43-45 (emphasis added).)

14. As another example, AGNC’s U.S. Patent No. 6,671,648 (the “’648 patent”), which was filed on October 22, 2001 and claims priority to an application filed January 4, 2000, indicates that “[p]rolific MEMS angular rate sensor approaches have been developed to meet the need for inexpensive yet reliable angular rate sensors in fields ranging from automotive to consumer electronics.” (EX1056 ('648 patent), 2:24-27 (emphasis added).) Furthermore, the '648 patent indicates that “MEMS angular rate sensors and MEMS accelerometers are **available commercially** and have achieved micro chip-size and low power consumption[.]” (*Id.*, 2:47-49 (emphasis added).) The '648 patent also provides the following discussion regarding MEMS sensors:

Single input axis MEMS angular rate sensors are based on either translational resonance, such as tuning forks, or structural mode resonance, such as vibrating rings. Moreover, dual input axis MEMS angular rate sensors may be based on angular resonance of a rotating rigid rotor suspended by torsional springs. Current MEMS angular rate sensors are primarily based on an electronically-driven tuning fork

method.

(*Id.*, 2:28-35.)

15. Dr. Larson also asserts that “an undergraduate Engineering student would have been unlikely to have encountered opportunities to study” MEMS devices. (EX2019, ¶ 58.) But this assertion appears to be based on his erroneous opinion that “there was no established industry or large body of academic work in MEMS devices[,]” which is incorrect for the reasons discussed above. (*Id.*) In my opinion, given that MEMS technology was advanced at the time of the ’122 patent, including as to MEMS inertial sensors, an undergraduate would likely have been exposed to this area of technology. Moreover, it is unclear why the educational opportunities of an undergraduate student have any relevance to the obviousness inquiry. I understand from counsel that obviousness is assessed from the standpoint of a person of ordinary skill in the art, who is not a mere undergraduate engineering student. Dr. Larson’s own formulation of a skilled artisan includes not just a Master’s Degree but also “approximately five years of relevant experience in the development of control systems for inertial navigation, MEMS semiconductor processing, and analog circuit design[.]” (EX2019, ¶57.) My own formulation includes “two to three years of practical experience designing and/or implementing systems that include sensors for measuring movement, such as acceleration and

rotational position.” (EX1002, ¶14.)

16. Accordingly, even if Dr. Larson were correct that an undergraduate engineering student would not likely have had an opportunity to study MEMS devices, the practical experience indicated by Dr. Larson’s formulation (and my own) would have given a person of ordinary skill experience with MEMS devices. Indeed, as I discussed above, MEMS devices were well established in research and industry by the time of the ’122 patent, including MEMS inertial sensors.

17. As noted previously, my opinions about the challenged claims of the ’122 patent would not change if I were to adopt Dr. Larson’s definition of a person of ordinary skill in the art. In fact, Dr. Larson’s formulation appears to be higher than the one I proposed in my opening declaration. Dr. Larson’s definition of a person of ordinary skill, if adopted, would only further strengthen my opinions as to the obviousness of the challenged claims over the prior art.

B. Response to Dr. Larson’s Opinions re ’122 Patent

18. Dr. Larson asserts that many companies and research institutions were working on commercial applications of MEMS in the late 1990s. (EX2019, ¶ 42.) I agree with Dr. Larson. However, it is also my view that many companies already offered commercially available MEMS devices *prior* to the late 1990s (*e.g.*, in the early 1990s). So in asserting that many companies and research institutions were

“working on commercial applications of MEMS in the late 1990s,” Dr. Larson, in my view, is both underestimating the advancement of commercial applications of MEMS devices (which were already available) by the late 1990s and ignoring commercial applications and work by companies and research institutions prior to the late 1990s—in fact, at least as early as the early 1990s.

19. In my view, Dr. Larson misrepresents the disclosures of the ’122 patent. Dr. Larson asserts that “[t]he patent also explained that designing and manufacturing working MEMS-based sensor products was ‘still very challenging,’ due to the high demands for, *e.g.*, accuracy and stability.” (EX2019, ¶ 44.) In support of this opinion, Dr. Larson cites to the ’122 patent, 2:1-4. (*Id.*) But in my view, neither that portion of the ’122 patent—nor any other portion—supports Dr. Larson’s statement. The portion of the ’122 patent specification Dr. Larson cites is reproduced below:

However, it is still very challenging work to design and manufacture a MEMS angular rate sensor with high accuracy, keen sensitivity, wide dynamic range, and high stability.

(EX1001, 2:1-4.) But the challenged claims of the ’122 patent do not require “high accuracy, keen sensitivity, wide dynamic range, [or] high stability.” (*Id.*) And the ’122 patent specification makes no representation about the “high demands” for

“accuracy and stability,” like Dr. Larson asserts. (EX2019, ¶ 44.) Accordingly, it is my opinion that this statement in the ’122 patent specification does not have any bearing on the challenged claims. Furthermore, there is nothing in the ’122 patent to suggest that designing and manufacturing working MEMS-based sensor products was “still very challenging” at the time of the ’122 patent. (EX2019, ¶ 44.) Indeed, in my view, MEMS sensors were well established at the time of the ’122 patent and designing and manufacturing working MEMS-based sensor products would have been well within the knowledge of a person of ordinary skill.

C. Response to Dr. Larson’s Opinions re Ground 1

20. Dr. Larson opines regarding Fujiyoshi’s circuit loop that controls the motion of the sensor proof mass 1 in the vibrating axis of the Figure 9 circuit. (EX2019, ¶¶ 63-64.) Dr. Larson opines that this loop—which feeds back a signal from the capacity detecting circuit 170 to self-exciting circuit 176, amplitude control circuit 177, and alternating amplifier 179—“does not contain any digital components.” (*Id.*, ¶ 64.) I disagree.

21. I disagree with Dr. Larson’s unsupported contention that the vibration control loop in Fujiyoshi’s Figure 9 circuit does not contain any digital components. Rather, Fujiyoshi does not say whether the elements in the vibration control loop in its Figure 9 circuit are implemented as digital or analog components. Figure 9 is a

block diagram, meaning that each block is a building block that a person of ordinary skill would have understood could be implemented in various ways. For example, a person of ordinary skill would have understood that blocks in the vibration control loop of Fujiyoshi's Figure 9 circuit could be implemented using either analog or digital circuitry.

22. Dr. Larson's own opinions undermine his contention that this control loop disclosed by Fujiyoshi does not contain digital components. Larson states that "the amplitude control circuit 177 is not described[.]" (EX2019, ¶ 64.) Furthermore, Larson states that the function of the amplitude control circuit 177 "**could** be performed by a simple analog circuit, such as an analog peak detector combined with an analog feedback loop, but the details are not given in *Fujiyoshi*." (*Id.*) (bold/underlined emphasis added; italics in original). In other words, Dr. Larson himself indicates that he cannot say for sure whether or not any of the components in Fujiyoshi's vibration control loop are implemented using digital or analog circuitry. Instead, Dr. Larson can only opine that circuitry in the vibration control loop *could* be implemented in analog circuitry. But Dr. Larson points to no evidence for his contention that the vibration control loop in Fujiyoshi's Figure 9 circuit "does not contain any digital components." (EX2019, ¶ 64.)

23. Furthermore, in my opinion, a person of ordinary skill would have

understood that certain functionality Fujiyoshi describes would have been implemented using digital circuitry. For example, Fujiyoshi discloses in discussing the Figure 9 circuit that “when the voltage applied to frequency adjusting electrodes **70, 72, 74, and 76** is swept with monitoring the vibration to the detecting direction generated by the coupling by means of the capacity detecting electrodes **30, 31, and 32**, the resonance characteristic in the detecting direction can be known. The resonance frequency in the detecting direction is obtained by the peak value of the amplitude obtained here.” (EX1003, 21:35-42.) In my opinion, a person of ordinary skill would have performed this frequency sweeping and amplitude monitoring process disclosed by Fujiyoshi using digital signal processing. For example, a person of ordinary skill would have understood that the amplitude could be sampled to determine the peak value and the corresponding resonant frequency in detecting direction while sweeping frequencies, which a person of ordinary skill would have understood to be performed in the digital domain. Accordingly, a person of ordinary skill would have understood, based on the disclosures of Fujiyoshi, that digital signal processing could be used with Fujiyoshi’s circuit.

24. Dr. Larson falsely asserts that I did “not cite to any teaching of *Fujiyoshi*” to support my opinion that the challenged claims would have been obvious based on Fujiyoshi in light of Townsend and Cox. (EX2019, ¶ 65.) But

contrary to Dr. Larson’s assertion, I repeatedly cited to Fujiyoshi in support of my obviousness opinions. For example, I cited to various Fujiyoshi disclosures in support of my opinion that Fujiyoshi and Townsend are analogous references. (EX1002, ¶ 183.) Further, I cited to Fujiyoshi—including by providing an annotated version of Fujiyoshi’s Figure 9 circuit—in support of my opinion that a person of ordinary skill would have considered the teachings of Townsend applicable to the control circuit loops of Fujiyoshi. (*Id.*, ¶ 184.) Additionally, I cited to Fujiyoshi in support of my opinion that a person of ordinary skill would have been motivated, including based on Fujiyoshi’s disclosures, to incorporate circuitry for rejecting noise into the combined circuit. (*Id.*, ¶ 186.) I also cited to Fujiyoshi’s disclosures in support of my opinions regarding the combination with Cox. (*See, e.g., id.*, ¶¶ 169-170.) Furthermore, my opinions regarding the combination of Fujiyoshi, Townsend, and Cox are generally based on my detailed analysis of Fujiyoshi’s disclosures as I provided throughout my opening declaration. (*Id.*, ¶ 185 (discussing Townsend’s disclosure of control circuitry in a vibrating structure gyroscope like Fujiyoshi discloses); *see also id.*, Sections VI.A.1, VI.B.)

25. Dr. Larson opines that a person of ordinary skill would not have found the “very complex modification” of Fujiyoshi’s circuit in light of Townsend and Cox to be obvious. (EX2019, ¶ 66.) I disagree with Dr. Larson’s opinion in several

respects.

26. *First*, I do not agree that a person of ordinary skill in the art would have found the combination of Fujiyoshi with Townsend and Cox to be “complex”—let alone “very complex.” (EX2019, ¶ 66.) Rather, in my view, a person of ordinary skill in the art would have found the combination of Fujiyoshi with Townsend and Cox to involve the use of conventional digital signal processing components (including analog-to-digital and digital-to-analog converters, processor, and a sample and hold device) in Fujiyoshi’s sensor. Furthermore, a person of ordinary skill would have been able to use these digital signal processing components in Fujiyoshi’s circuit using predictable, routine techniques. For example, I had experience designing “mixed signal” (*i.e.*, analog and digital) MEMS motion sensors in the early 1990s, several years before the ’122 patent.

27. *Second*, Dr. Larson appears to misconstrue my opinion, suggesting that the *only* combination of Fujiyoshi and Townsend that I am asserting would have been obvious would have been to connect node “c” in Fujiyoshi’s Figure 9 circuit to digital signal processing circuitry. (EX2019, ¶ 65.) I disagree. One “example” of a circuit that would have been obvious to a person of ordinary skill based on the Fujiyoshi, Townsend, and Cox combination that I opined about in my opening declaration is connecting circuitry as taught by Townsend and Cox to node “c” in

the Fujiyoshi Figure 9 circuit. (EX1002, ¶¶ 180-181.) However, this was simply a non-limiting “example.” In my opening declaration, I alternatively discussed that a person of ordinary skill would have been motivated to incorporate circuitry as taught by Townsend and Cox into the amplitude control circuit 177 disclosed in Fujiyoshi’s Figure 9 circuit. (*Id.*, ¶ 181.) Generally, my opinion is that a person of ordinary skill would have been motivated to incorporate circuitry as taught by Townsend and Cox into the dither drive loop of a MEMS vibratory gyroscope as disclosed by Fujiyoshi—regardless of any particular combined circuit design. It is my opinion that a person of ordinary skill would have had the knowledge to combine Fujiyoshi, Townsend, and Cox without undue experimentation such that the challenged claims are satisfied.

28. *Third*, even if Dr. Larson were correct that a person of ordinary skill in the art would have considered the Fujiyoshi, Townsend, and Cox combination to be complicated (which I disagree with, as discussed above), it is my opinion that a person of ordinary skill would have found it obvious—and would have been motivated—to combine Fujiyoshi, Townsend, and Cox. A person of ordinary skill would have viewed any alleged complicatedness of the Fujiyoshi, Townsend, and Cox combination as a trade-off outweighed by the substantial benefits of the combination. For example, as I discussed in my opening declaration, a person of

ordinary skill would have viewed the “mixed signal” combination of Fujiyoshi, Townsend, and Cox to be more flexible than a strictly analog system, since it would have been more easily calibrated, compensated, and incorporated into other modern systems. (EX1002, ¶¶ 163-172, 185 (citing Townsend at 3).) Furthermore, a person of ordinary skill would have been motivated to combine Fujiyoshi, Townsend, and Cox based on various other motivations to combine I discussed in my opening report—including the difficulty of designing and specifying analog circuitry control loops and the compatibility of digital outputs with other digital systems. (EX1002, ¶¶ 163-172, 185-186.)

29. Dr. Larson asserts that “[t]he *Townsend* reference does not disclose any specific benefit that would have been deemed applicable to the complete analog feedback loop taught in *Fujiyoshi*.” (EX2019, ¶ 67.) I disagree. As I discussed in my opening declaration, several of Townsend’s disclosures would have indicated to a person of ordinary skill that it is directly applicable to Fujiyoshi’s MEMS vibratory gyroscope designs. (EX1002, ¶ 185.)

30. Furthermore, Dr. Larson’s opinion regarding the applicability of Townsend to Fujiyoshi appears to be based on mischaracterizations of Fujiyoshi’s disclosures in an effort to make Fujiyoshi look more “complete” or “solved” than a person of ordinary skill would have understood. Dr. Larson asserts that “*Fujiyoshi*

already teaches an analog circuit design that purportedly solves problems of noise, sensitivity, and reliability.” (EX2019, ¶ 67.) I disagree. Fujiyoshi merely discloses techniques that can “improve[]” certain aspects of a sensor or lead to “high reliability.” (EX1003 (Fujiyoshi), 6:35-53, 8:23-48.) But contrary to Dr. Larson’s assertions, none of these disclosures would have indicated to a person of ordinary skill that Fujiyoshi “solve[d]” any of these issues. (EX2019, ¶ 67.) In my opinion, a person of ordinary skill in the art would have continued to seek to improve aspects of the Fujiyoshi circuit like noise, reliability, linearity, sensitivity, frequency characteristic, temperature characteristic, etc. Indeed, in my opinion, a person of ordinary skill in the art would have combined Fujiyoshi with Townsend and Cox in part to improve such features of the Fujiyoshi sensor.

D. Response to Dr. Larson’s Opinions re Ground 2

31. Dr. Larson opines regarding Mitamura’s circuit loop that controls the motion of the sensor proof mass in the vibrating axis. (EX2019, ¶¶ 70-71.) Dr. Larson opines that this loop “does not contain any digital components.” (*Id.*, ¶ 71.) I disagree.

32. I disagree with Dr. Larson’s unsupported contention that the vibration control loop in Mitamura’s Figure 26 circuit does not contain any digital components. Rather, Mitamura does not say whether the elements in the vibration

control loop in Mitamura's Figure 26 circuit are implemented as digital or analog components. Figure 26 is a block diagram, meaning that each block is a building block that a person of ordinary skill would have understood could be implemented in various ways. For example, a person of ordinary skill would have understood that building blocks in the vibration control loop of the Mitamura's Figure 26 circuit could be implemented using either analog or digital circuitry.

33. For example, as I discussed in my opening declaration, a person of ordinary skill would have understood that arithmetic unit 91 in Mitamura's Figure 26 circuit could be implemented as a digital component. (EX1002, ¶¶ 232, 237-238.) At the very least, it would have been obvious to a person of ordinary skill to implement arithmetic unit 91 in Mitamura's Figure 26 circuit as a digital component. (*Id.*)

34. Dr. Larson's own opinions undermine his contention that this control loop disclosed by Mitamura does not contain digital components. Larson states that "the arithmetic unit 91 is not described[.]" (EX2019, ¶ 71.) Furthermore, Larson states that the function of the arithmetic unit 91 "**could** be performed by a simple analog circuit, such as a subtractor, but the details are not given in *Mitamura*." (*Id.*) (bold/underlined emphasis added; italics in original). In other words, Dr. Larson himself indicates that he cannot say for sure whether or not any of the components

in Mitamura's vibration control loop are implemented using digital or analog circuitry. Instead, Dr. Larson can only opine that circuitry in the vibration control loop *could* be implemented in analog circuitry. But Dr. Larson points to no evidence for his contention that the vibration control loop in Mitamura's Figure 26 circuit "does not contain any digital components." (EX2019, ¶ 71.)

35. Dr. Larson falsely asserts that I did "not cite to any teaching of *Mitamura*" to support my opinion that the challenged claims would have been obvious based on Mitamura alone, or in light of Townsend. (EX2019, ¶ 72.) But contrary to Dr. Larson's assertion, I repeatedly cited to Mitamura in support of my obviousness opinions. For example, I cited to various Mitamura disclosures in support of my opinion that Mitamura and Townsend are analogous references. (EX1002, ¶ 242.) Further, I cited to Mitamura—including by providing an annotated version of Mitamura's Figures 21 and 26—in support of my opinion that a person of ordinary skill would have considered the teachings of Townsend applicable to the control circuit loops of Mitamura. (*Id.*, ¶¶ 243, 246.) Additionally, I cited to Mitamura in support of my opinion that a person of ordinary skill would have been motivated, including based on Mitamura's disclosures, to incorporate circuitry for rejecting noise into the combined circuit. (*Id.*, ¶ 245.) Furthermore, my opinions regarding the combination of Mitamura and Townsend are generally based on my

detailed analysis of Mitamura’s disclosures as I provided throughout my opening declaration. (*Id.*, ¶ 244 (discussing Mitamura’s disclosure of control circuitry in a vibrating structure gyroscope); *see also id.*, Sections VI.A.5, VI.C.)

36. Dr. Larson opines that a person of ordinary skill would not have found the “very complex modification” of Mitamura’s circuit in light of Townsend to be obvious. (EX2019, ¶ 73.) I disagree with Dr. Larson’s opinion in several respects.

37. *First*, I do not agree that a person of ordinary skill in the art would have found the modified Mitamura circuit or the combination of Mitamura with Townsend to be “complex”—let alone “very complex.” (EX2019, ¶ 73.) Rather, in my view, a person of ordinary skill in the art would have found the combination of Mitamura with Townsend to involve the use of conventional digital signal processing components (including analog-to-digital and digital-to-analog converters, processor, and a sample and hold device) in Mitamura’s sensor. Furthermore, a person of ordinary skill would have been able to use these digital signal processing components in Mitamura’s circuit using predictable, routine techniques. For example, I had experience designing “mixed signal” (*i.e.*, analog and digital) MEMS motion sensors in the early 1990s, several years before the ’122 patent.

38. *Second*, Dr. Larson appears to misconstrue my opinion, suggesting that

the *only* combinations of Mitamura and Townsend that I am asserting would have been obvious are (1) to implement the arithmetic unit 91 as a digital signal processor or (2) to add a digital signal processor downstream of arithmetic unit 91. (EX2019, ¶¶ 72-73.) I disagree. These are both examples I provided in my opening declaration. (EX1002, ¶ 240.) However, these were simply non-limiting “example[s].” (*Id.*) Generally, my opinion is that a person of ordinary skill would have been motivated to incorporate digital signal processing circuitry as taught by Townsend into the dither drive loop of a MEMS vibratory gyroscope as disclosed by Mitamura—regardless of any particular combined circuit design. It is my opinion that a person of ordinary skill would have had the knowledge to combine Mitamura and Townsend without undue experimentation such that the challenged claims are satisfied.

39. *Third*, even if Dr. Larson were correct that a person of ordinary skill in the art would have considered the proposed modification of Mitamura or the combination of Mitamura and Townsend to be complicated (which I disagree with, as discussed above), it is my opinion that a person of ordinary skill would have found it obvious—and would have been motivated—to modify Mitamura or combine Mitamura and Townsend. A person of ordinary skill would have viewed any alleged complicatedness of the modified or combined system as a trade-off outweighed by

substantial benefits of using digital signal processing in the control circuitry. For example, as I discussed in my opening declaration, a person of ordinary skill would have viewed the “mixed signal” modification of Mitamura or combination of Mitamura and Townsend to be more flexible than a strictly analog system, since it would have been more easily programmable and adjustable. (EX1002, ¶ 244 (citing Townsend at 3).) Furthermore, a person of ordinary skill would have been motivated to combine Mitamura and Townsend based on various other motivations to combine I discussed in my opening declaration—including the difficulty of designing and specifying analog circuitry control loops and the compatibility of digital outputs with other digital systems. (EX1002, ¶¶ 244-245.)

40. Dr. Larson asserts that “[t]he *Townsend* reference does not disclose any specific benefit that would have been deemed applicable to the complete analog feedback loop taught in *Mitamura*.” (EX2019, ¶ 74.) I disagree. As I discussed in my opening declaration, several of Townsend’s disclosures would have indicated to a person of ordinary skill that it is directly applicable to Mitamura’s MEMS vibratory gyroscope designs. (EX1002, ¶ 244.)

41. Furthermore, Dr. Larson’s opinion regarding the applicability of Townsend to Mitamura appears to be based on mischaracterizations of Mitamura’s disclosures in an effort to make Mitamura look more “complete” or “solved” than a

person of ordinary skill would have understood. Dr. Larson asserts that “*Mitamura* already teaches an analog circuit design that purportedly solves problems of noise, sensitivity, and precision.” (EX2019, ¶ 74.) I disagree. *Mitamura* merely discloses that its system is not susceptible to certain types of noise and amplitude variation. (EX1009 (*Mitamura*), Abstract, [0034].) But contrary to Dr. Larson’s assertions, none of these disclosures would have indicated to a person of ordinary skill that *Mitamura* “solve[d]” any of these issues. (EX2019, ¶ 74.) In my opinion, a person of ordinary skill in the art would have continued to seek to improve aspects of the *Mitamura* circuit like noise, sensitivity, and precision, etc. Indeed, in my opinion, a person of ordinary skill in the art would have modified *Mitamura* or combined *Mitamura* with Townsend in part to improve such features of the *Mitamura* sensor.

**E. Response to Dr. Larson’s Opinions re Digital Signal Processing
with MEMS Gyroscopes**

42. Dr. Larson opines that it would not have been obvious to a person of ordinary skill to insert a digital signal processing system into the control loop of a sensor like those discussed in the references I identified. (EX2019, ¶ 81.) For the reasons discussed in my opening declaration, it is my opinion that it would have been obvious to implement, for example, Fujiyoshi’s Figure 9 circuit using digital signal processing in the dither control loop in light of the teachings of Townsend and

Cox. Furthermore, it is my opinion that it would have been obvious to implement, for example, Mitamura's disclosed circuitry using digital signal processing in the dither control loop, either based on Mitamura alone or in light of the teachings of Townsend. Additionally, I disagree with Dr. Larson's suggestion that it is my opinion that a person of ordinary skill would have been motivated to "insert a digital signal processing system into the dither control loop" of Fujiyoshi or Mitamura. (EX2019, ¶ 81.) Rather, it is my opinion that a person of ordinary skill would have been motivated to design a system like Fujiyoshi or Mitamura's with digital signal processing in the dither motion control loop, and a person of ordinary skill would have been capable of designing such a system without undue experimentation.

43. Dr. Larson opines that a person of ordinary skill would not have had sufficient experience with digital signal processing. (EX2019, ¶¶ 81, 84.) I disagree. In my opinion, a person of ordinary skill in the art would have had sufficient experience with and knowledge about digital signal processing to use such processing in the dither drive loop of a MEMS gyroscope, as I discussed in my opening declaration for Grounds 1 and 2. In my opinion, a person of ordinary skill would have had experience and familiarity with digital signal processing based on their education and work experience. As I discussed in my opening declaration, it is my opinion that a person of ordinary skill would have had a Bachelor's degree in

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electrical engineering or similar degree, with two to three years of practical experience designing and/or implementing systems that include sensors for measuring movement, such as acceleration and rotational position. (EX1002, ¶ 14.)

In my opinion, a person of ordinary skill would have gained experience and familiarity with digital signal processing during their undergraduate education and through their practical experience. For example, by the time of the '122 patent, I had experience with mixed-signal processing both based on my undergraduate educational experience and my practical experience working on mixed-signal design and simulation for MEMS accelerometers.

44. Furthermore, as I discuss below in response to Mr. McCall's declaration, whether a person of ordinary skill in the art had Mr. McCall's allegedly advanced experience with digital signal processing techniques has no bearing on the challenged claims, because the challenged claims do not require any particularly sophisticated forms of digital signal processing. (*See infra* Section IV.)

45. Dr. Larson opines that a person of ordinary skill would not have known how to apply "sophisticated signal processing techniques," "complicated" digital signal processing, or undefined "algorithms" to a MEMS inertial sensor. (EX2019, ¶¶ 82-84.) I disagree.

46. Nothing in the challenged claims of the '122 patent requires the

complicated or sophisticated digital signal processing techniques—nor would a person of ordinary skill have viewed such techniques to be complicated or sophisticated. Rather, the only recitation of “digital signal processing” in the challenged claims is the requirement in claim 1 of “a digital signal processing system analyzing said digital low frequency inertial element displacement signals and feeding back said dither driver signals to said angular rate sensor unit.” (EX1001, cl. 1.) Nothing in this language requires a complicated or sophisticated use of digital signal processing as Dr. Larson suggests. (EX2019, ¶¶ 82, 84.) Furthermore, a person of ordinary skill would not have understood the language of claim 1 to require a “complicated application of digital signal processing[.]” (*Id.*, ¶ 84) Rather, claim 1 merely requires that a digital signal processing system “analyz[e] ... digital low frequency inertial element displacement signals” and “feed[] back ... dither driver signals[.]” (EX1001, cl. 1.) A person of ordinary skill would have understood that these analysis and feedback steps could be achieved via routine digital signal processing. A person of ordinary skill would not have understood that any particular complicated or sophisticated digital signal processing would have been necessary to meet the requirements of claim 1.

47. Dr. Larson’s opinions regarding the ’122 patent appear to confirm that no particular complicated or sophisticated digital signal processing is necessary to

satisfy the requirements of claim 1. Dr. Larson opines that “**Claim 1 does not require a particular analysis**” for the digital signal processing limitation, instead providing “various examples of the analysis that can be performed on the digital signals” in Figure 7 of the ’122 patent, reproduced below. (EX2019, ¶ 47 (emphasis added).)

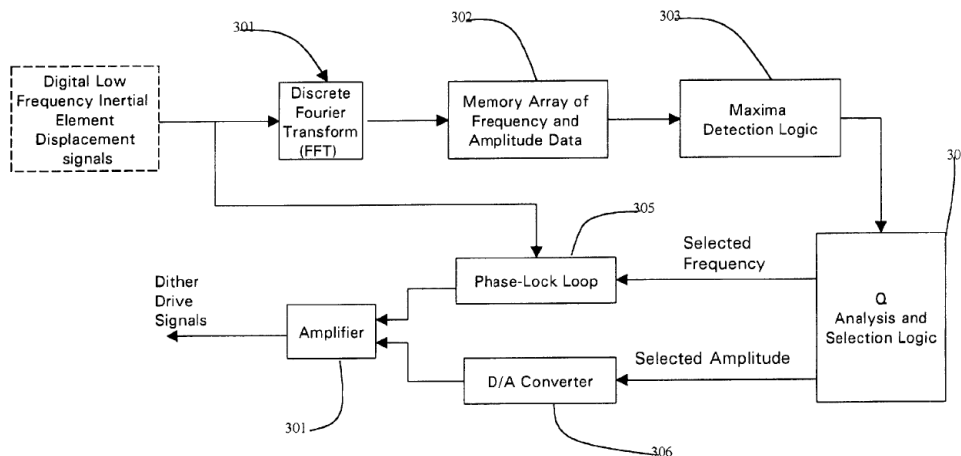


Figure 7

(EX1001, Fig. 7.) Dr. Larson indicates that no “particular analysis” is required by claim 1 of the ’122 patent. (EX2019, ¶ 47.) So there is no basis for suggesting that a “complicated application of digital signal processing” is necessary for the challenged claims to be satisfied. (*Id.*, ¶ 84.)

48. I agree with Dr. Larson that the challenged claims of the ’122 patent do not require any particular form of digital signal processing. Therefore, in my opinion, whether it would have been obvious to a person of ordinary skill to use a

“complicated application of digital signal processing” in a MEMS angular rate sensor control loop has no bearing on the challenged claims. (EX2019, ¶ 84.) For example, Figure 7 of the ’122 patent indicates that any of the following forms of digital signal processing could meet the claim requirement of a “digital signal processing system analyzing” signals: discrete Fast Fourier transform (FFT), maxima detection logic, and Q analysis and selection logic. (See EX1001, Fig. 7, 9:7-12, 9:17-27.) A person of ordinary skill would have considered these to be straightforward digital signal processing. A person of ordinary skill would not have understood any of these examples of digital signal processing to be a “complicated application of digital signal processing.” (EX2019, ¶ 84.)

49. Dr. Larson also opines that MEMS technology was in its “infancy” or an “immature state” at the time of the ’122 patent. (EX2019, ¶¶ 82, 83.) I disagree. As I discuss throughout this and my opening declaration, MEMS technology, including MEMS inertial sensors, had existed for many years at the time of the ’122 patent. There were many commercial devices, including MEMS inertial sensors, available at the time of the ’122 patent. Some examples of MEMS inertial sensors commercially available prior to the ’122 patent include the Analog Devices ADXL05, the Analog Devices ADXL50, the Crossbow DMU-6X, the Crossbow DMU-VGX, and the MSI ACH-04-08-05. (EX1063 (MSI ACH-04-08-05 data

sheet); EX1064 (Analog Devices ADXL05 data sheet); EX1065 (Analog Devices ADXL50 data sheet); EX1053 (Crossbow DMU-6X and DMU-VGX data sheet).) Furthermore, a substantial body of research on MEMS technology existed at the time of the '122 patent.

50. Dr. Larson opines that a person of ordinary skill “would only find digitization, and the application of digital signal processing to MEMS sensor control loops, to be obvious *in hindsight*[.]” (EX2019, ¶ 83 (*italics in original*)).) I disagree.

51. My own experience in the early 1990s as a graduate student at UC Berkeley contradicts Dr. Larson’s opinion. I worked on digital signal processing in MEMS sensor control loops years before the '122 patent.

52. Furthermore, in my opinion, various prior art references contradict Dr. Larson’s opinion. For example:

a. I understand that International Patent Application No. WO 97/45699 to William A. Clark (“Clark”) is prior art to the '122 patent, including because it was filed May 30, 1997 and published December 4, 1997. (EX1057, p. 1.) I understand that Dr. Larson testified that he had never seen this reference. (EX1046, 31:12-32:15.) Clark discloses that it “relates generally to micro-fabricated sensors, and more particularly to microfabricated gyroscopic sensors.” (EX1057, 1:5-7.) Clark discloses MEMS vibratory gyroscopes, including the design shown in

Input Axis Rate Gyroscope” by Thor Nelson Juneau (“Juneau”) is prior art to the ’122 patent, including because it was published in 1998 or earlier. (EX1037, pp.4-5.) I understand that Mr. Larson testified that he had never seen this reference. (EX1048, 22:8-25.) Juneau discloses MEMS gyroscopes that use digital signal processing in the control loops, including with the “Phase-locked-loop” and connected blocks shown in Figure 4-1:

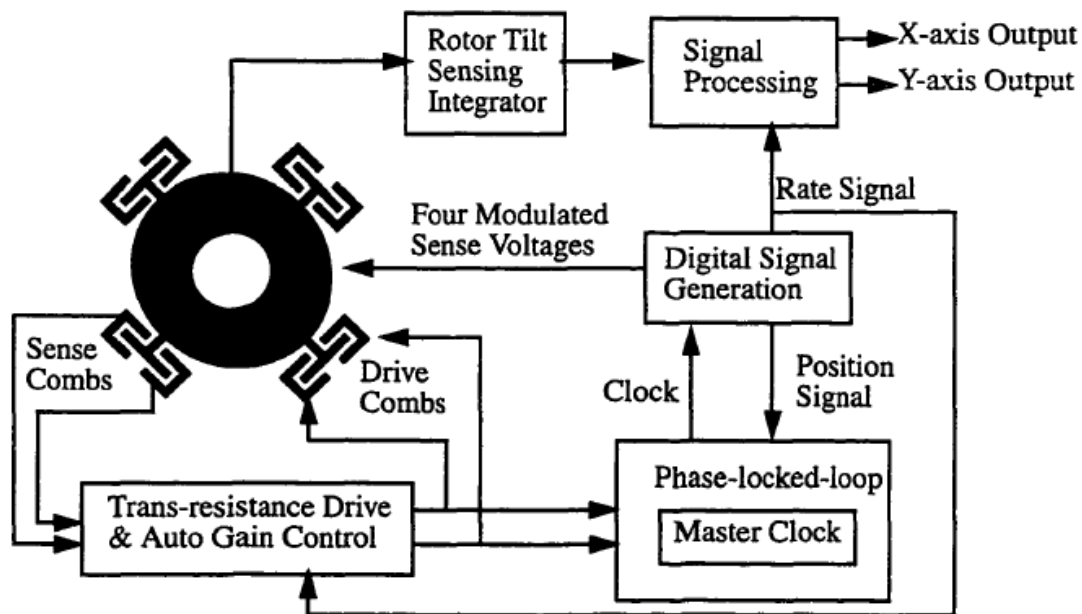


Figure 4-1. System level schematic showing entire dual-axis gyroscope electronics.

(EX1037, Fig. 4-1, pp. 66-79.)

IV. RESPONSE TO MR. MCCALL

53. I have reviewed Hiram McCall’s Declaration (EX2023) and provide the following opinions and analysis in response.

54. Mr. McCall indicates that AGNC has had commercial success due to the alleged inventions of the '122 patent. (EX2023, ¶¶ 3, 20.) However, Mr. McCall provides no evidence of any commercial success by AGNC. Furthermore, Mr. McCall provides no analysis to indicate that any commercial success by AGNC was attributable to the alleged inventions of the '122 patent.

55. Mr. McCall opines that his level of experience in digital signal processing was out of the ordinary for engineers working in MEMS sensors at the time. (EX2023, ¶ 6.) In my opinion, to the extent Mr. McCall had a higher level of experience in digital signal processing than a person of ordinary skill, it has no bearing on the challenged claims. As I discuss above, the challenged claims do not require any particular form of digital signal processing. Instead, as Dr. Larson agrees, claim 1 merely requires *some* form of “digital signal processing” that can “analyz[e]” and “feed[] back” signals. (EX2019, ¶ 47 (citation omitted).) Accordingly, in my opinion, a person of ordinary skill in the art would not have needed to possess sophisticated experience with digital signal processing (or Mr. McCall’s alleged level of experience) for it to have found the challenged claims obvious over the prior art, or to have implemented digital signal processing in the dither drive loop of a MEMS gyroscope.

56. Mr. McCall opines that building a “commercially and technically viable

gyroscope from silicon MEMS technology” was seen as a “significant technical challenge” before the ’122 patent. (EX2023, ¶ 7.) I disagree. In my opinion, there were many examples of commercially and technically viable gyroscopes from silicon MEMS technology in products and research prior to the ’122 patent. For example, several of the prior art references identified in this proceeding represent commercially and technically viable gyroscopes from silicon MEMS technology that existed at the time Mr. McCall started at AGNC. Furthermore, there were many other examples of commercially and technically viable gyroscopes from silicon MEMS technology in products and research prior to the ’122 patent. (*See, e.g.*, EX1057 (WO 97/45699 to William A. Clark), 1:5-7, 29:13-24, 41:20-42:10, 43:17-19, Figs. 9 & 18; EX1037 (Juneau, “Micromachined Dual Input Axis Rate Gyroscope” (1998)), pp. 4-5, 66-79, Fig. 4-1; EX1053 (“Crossbow DMU-6X and DMU-VGX Silicon IMU and Vertical Gyro” (1998)).)

57. Furthermore, in my opinion, whether a commercially and technically viable gyroscope from silicon MEMS technology was seen as a significant technical challenge prior to the ’122 patent has no bearing on the challenged claims. Even if this statement were accurate (which it is not as described above), nothing in the challenged claims requires a commercially and technically viable gyroscope from silicon MEMS technology.

58. Mr. McCall makes various claims about MEMS sensors in aircraft or vehicular navigation products at the time of the '122 patent. (EX2023, ¶ 8.) These statements have no bearing on the challenged claims in my opinion, because nothing in the challenged claims requires use or applicability in an aircraft or vehicular navigation product.

59. Mr. McCall makes various claims about MEMS accelerometers and gyroscopes, suggesting that a MEMS accelerometer is a “fairly simple” device and that a gyroscope “is generally a much more complicated device than an accelerometer.” (EX2023, ¶¶ 9-10.) I disagree with Mr. McCall’s assertions. I do not view a MEMS accelerometer as fairly simple, which is vague and highly subjective. Additionally, I do not view MEMS gyroscopes as “much more complicated” than MEMS accelerometers, which, again, is vague and highly subjective. (EX2023, ¶ 10.) MEMS gyroscopes operate differently than MEMS accelerometers. For example, MEMS vibratory gyroscopes require dither motion to be controlled, which is not required in MEMS accelerometers. However, in my opinion, the differences between MEMS gyroscopes and MEMS accelerometers only support my view that it would have been obvious to use digital signal processing in the dither motion control loop of a MEMS gyroscope. Digital signal processing was commonly used with MEMS accelerometers at the time of the '122

patent. Indeed, I designed and simulated digital signal processing circuitry for a MEMS accelerometer in the early 1990s, several years before the '122 patent. Furthermore, there is ample prior art disclosing the use of digital signal processing with MEMS accelerometers. (See EX1058 (Lemkin, “Micro Accelerometer Design with Digital Feedback Control” (1997)); EX1059 (Lu, “A Monolithic Surface Micromachined Accelerometer with Digital Output” (1995)); EX1060 (W. Yun, “Surface Micromachined, Digitally Force-Balanced Accelerometer [sic] with Integrated CMOS Detection Circuitry” (1992)).) The additional demands and functionality of a MEMS gyroscope—for example, the required dither motion in a MEMS vibratory gyroscope—would have led a person of ordinary skill to consider digital signal processing (already applied to accelerometers) for use in the context of MEMS gyroscopes.

V. FURTHER RESPONSIVE OPINIONS

60. I understand that Patent Owner is suggesting that certain textbooks—Slater (EX1011); Ristic (EX1010); and Irwin (EX1013)—I cited to in my opening declaration would not necessarily have been in the knowledge of a person of ordinary skill. I disagree. As I opined in my opening declaration, these textbooks reflect the background knowledge that a person of ordinary skill would have had. (EX1002, ¶¶135, 138, 139, 147, 171.) For example:

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a. Slater was published in 1964—around 35 years before the alleged priority date of the '122 patent. Slater discloses that it “may be thought of as a supplement to general treatises on inertial guidance.” (EX1011, p.iv.) Slater further discloses:

[B]y examining the whole field of inertial guidance sensors, as is done in the present text, it is possible to reveal common principles and to show a unity which is not readily discernible by unconnected studies of isolated instruments. Such background will be of aid in understanding existing instruments and their limitations, in relating proposals for novel instruments to the existing state of the art, and in choosing the most practical lines of attack in research and development.

(EX1011, pp.v-vi.) Slater’s publication year and disclosures support my view that it reflects what would have been in the background knowledge of a person of ordinary skill.

b. Ristic was published in 1994—around 5 years before the alleged priority date of the '122 patent. Ristic discloses:

The book is intended for practicing engineers, scientists, and advanced graduate students who seek a broader understanding on important subjects in the sensor field. Many of the presented topics are considered crucial in today’s sensor technology.... It is my sincere wish that the combination of the variety of topics and depth offered in this book will make it a valuable reference as well as a useful teaching text.

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(EX1061, p.xiv.) Ristic's publication year and disclosures support my view that it reflects what would have been in the background knowledge of a person of ordinary skill.

c. Irwin was published in 1997—around 2 years before the alleged priority date of the '122 patent. Irwin discloses:

The purpose of [Irwin] is to provide a reference that is both concise and useful for individuals who range from students in engineering to experienced practicing professionals. The Handbook is designed to cover a very wide range of topics that comprise the subject of industrial electronics in a well-organized and highly informative manner.... Special emphasis is placed on the practical application of the technologies discussed. Thus this Handbook is not a theoretical tome, but an enlightening presentation of the usefulness of the variety of technological entities that encompass the field. In an effort to further enhance the value of the book to the reader and foster a clear understanding of the material, the presentation is tutorial in nature, and items, such as examples of the practical use of the technology described, have been deliberately included.

(EX1062, p.v.) Irwin's publication year and disclosures support my view that it reflects what would have been in the background knowledge of a person of ordinary skill.

61. I understand that Patent Owner is suggesting that noise is the only

rationale offered for the combination between Fujiyoshi and Townsend and that noise is an overbroad and generalized concern that is not a proper reason to combine. (Patent Owner Response at 25.) As I discussed in my deposition, improving noise is *not* the only motivation to combine I provided for combining Fujiyoshi and Townsend. (EX2020, 64:12-23 (“[I]f you look at my report, there are a lot of places [that] talk about various reasons why a person of ordinary skill in the art would have been motivated to proceed a combination.”).)

62. For example, I opined in my opening declaration that a person of ordinary skill would have been motivated to combine Fujiyoshi and Townsend because Townsend teaches that analog circuitry in control loops of vibrating structure gyroscope circuitry is “notoriously difficult to specify, design and integrate into small low cost systems (i.e. ASICS).” (EX1002, ¶ 185 (citing Townsend at 3).) Furthermore, I opined that a person of ordinary skill would have been motivated to combine Fujiyoshi and Townsend based on Townsend’s disclosure that it is “difficult to apply calibrations and compensations to systems based on analogue circuits[.]” (*Id.*) Additionally, I opined that a person of ordinary skill would have been motivated to combine Fujiyoshi and Townsend based on Townsend’s disclosure that “modern systems require the sensor outputs to be available in digital format to simplify system integration and enable further compensations to be applied

to enhance performance.” (*Id.*, ¶ 244.) Each of these disclosures in Townsend would have provided a person of ordinary skill motivation to combine Fujiyoshi and Townsend, each of which is separate from the noise-based motivation to combine I also identified. (*Id.*, ¶ 186.)

63. Furthermore, contrary to Patent Owner’s arguments, a person of ordinary skill would have been motivated to combine Fujiyoshi and Townsend including to reduce noise. I disagree with Patent Owner that noise is an “[o]verbroad and generalized concern.” (Patent Owner Response at 25.) In my opinion, noise is a particularly important issue in MEMS vibratory gyroscopes, so reducing noise would have been an important motivation to combine Fujiyoshi with other references like Townsend and Cox. For example, Fujiyoshi indicates that noise is generated in its disclosed circuits due to “noise (cross-talk) generated by the exciting signal electrically entering into the detecting circuit[.]” (EX1003, 6:50-53.) Furthermore, Fujiyoshi itself discloses techniques like differential outputs for “reduc[ing] noise influence” in its embodiments. (*Id.*, 12:60-64.) Accordingly, a person of ordinary skill in the art would have been particularly motivated to reduce noise in the context of Fujiyoshi’s circuit.

64. Additionally, I understand that Patent Owner challenges the inclusion of sample-and-hold devices in the combinations between (1) Fujiyoshi and

Townsend and (2) Mitamura and Townsend. As I described in my opening declaration, the sample-and-hold devices are simply part of Townsend's disclosed circuitry for sampling analog signals to convert from analog to digital signals. (EX1002, ¶¶77, 178-186, 237-245.) Thus, in my view, a person of ordinary skill would have been motivated to use sample-and-hold devices in incorporating digital processing circuitry like Townsend discloses into Fujiyoshi's circuit. For example, Townsend discloses that its sample-and-hold devices enable lower sample/conversion times than what prior art circuits used, which allows for "simple low cost precision analogue to digital converters to be used which can more readily be integrated into a monolithic integrated circuit." (Townsend, p.12 (sample-and-hold devices enable "interleaving of the samples to ensure no loss of information"); *see also id.*, pp.4-5 (describing issues with higher sample/conversion rates in the prior art).) Accordingly, Townsend is clear that the use of sample-and-hold devices is part of its proposed solution to problems with digitization in the prior art. Thus, in addition to being motivated to use sample-and-hold devices to reduce noise, a person of ordinary skill would have been motivated to use sample-and-hold devices based on the various motivations to use digital circuitry I discussed in my opening declaration. (EX1002, ¶¶77, 178-186, 237-245.)

65. I understand that Patent Owner points to an embodiment in Townsend

in which sigma-delta modulation is used and sample-and-hold devices are not used. However, this does not undermine Townsend's ample disclosures related to the use and advantages of using sample-and-hold devices in analog-to-digital conversion circuitry, as I discussed above. Rather, a person of ordinary skill would have seen Townsend's embodiment including sigma-delta modulation as a mere alternative circuit with various trade-offs compared to the embodiment involving sample-and-hold devices.

66. Patent Owner provides an out-of-context cite to my deposition transcript in which I indicated that if my opening declaration had only focused on reducing noise for the motivation to combine Fujiyoshi and Townsend, then "maybe" it would have been overbroad. (EX2020, 64:11-18.) But in context, my testimony makes clear that my opinion is that reducing noise was *not* the only motivation to combine:

MR. JOHANNINGMEIER:

Q. Right. Well, I mean, among those motivations, though, would you agree with me that the -- the sort of mention of noise is a little bit overbroad?

MR. LAUPPE: Object to form, and scope.

THE WITNESS: If I only focus on noise,

maybe it's overbroad; right? **But I don't want to --
you know, I don't want to limit myself to only noise
on that passage; right? Because if you look at my
report, there are a lot of places talk about various
reasons why a person of ordinary skill in the art
would have been motivated to proceed a combination.**

(EX2020, 64:11-23 (emphasis added).)

67. In my deposition, I testified about a research project I worked on starting in 2007, which involved incorporating a MEMS sensor into the shoe of a soldier to allow for position tracking in environments with no GPS signal. I worked on this project while I was a professor at Case Western Reserve University. I designed a flexible tactile sensor-based ground reaction sensor array and incorporated the sensor array as a part of shoe's insole. A commercial MEMS IMU was also installed to the shoe as a part of an overall personal navigation system. I understand that Patent Owner focuses on the fact that this project extended over a number of years. But as I testified in my deposition, the duration of this project resulted from the fact that it was a training opportunity for graduate students, and because there were changes in funding throughout the course of the project. Furthermore, this was a very specific application of MEMS sensors in a demanding application context (*i.e.*, a wearable shoe).

68. In my deposition, I also testified about a research project I worked on starting in 2003. In that project I designed a MEMS accelerometer and attached the accelerometer on the ossicular chain in the middle ear. The accelerometer detects the vibration of the ossicular chain when an acoustic stimulation is applied to the ear drum. The accelerometer, therefore, can serve as an implantable microphone for fully implantable cochlear prosthetic applications. As I testified in my deposition, the duration of this project resulted from the fact that it was a training opportunity for graduate students, for instance. Furthermore, this was a very specific application of MEMS sensors in a demanding application context (*i.e.*, implanted in the human ear).

VI. CONCLUSION

69. In signing this Declaration, I recognize that the Declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross-examination in this proceeding. If required, I will appear for cross-examination at the appropriate time. I reserve the right to offer opinions relevant to the invalidity of the challenged claims at issue and/or offer testimony in support of this Declaration.

70. I hereby declare that all statements made herein of my own knowledge are true and that all statements are made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001.

Dated: 4-15-2025

Respectfully submitted,

A handwritten signature in cursive script, appearing to read "Darrin Young", written over a horizontal line.

Darrin Young