I. Y. (Steve) Shen

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EDUCATION

Ph.D. University of California, Berkeley, CA., Mechanical Engineering, May 1991.

Major: Dynamics and Vibration

Minor: Solid Mechanics, Applied Mathematics

Mentor: C. D. Mote, Jr.

M.S. National Taiwan University, Taipei, Taiwan, Mechanical Engineering, June, 1986.
B.S. National Taiwan University, Taipei, Taiwan, Mechanical Engineering, June, 1981.

PROFESSIONAL EXPERIENCE

9/02 – present: **Professor**, Department of Mechanical Engineering, University of Washington, Seattle, WA.

- 1. Major research areas include disk drive dynamics (e.g., spindle motors, disk media, glide heads, and suspension systems), vibration of rotating machines (e.g., turbines, rotor-housing interaction), PZT thin-film micro-sensors and actuators (e.g., structural health monitoring sensors and microphones), medical applications (e.g., hearing implants, hearing aids, and dental implants), autonomous flying vehicles (e.g., flapping wings, thin-film rate gyro for guidance and motion control), nanotechnology (e.g., PZT nano-particles), flexible electronics and manufacturing (e.g., PZT ink printing and PZT-silane nano-composite thin films), damping technology (passive, active, and hybrid damping, isolation), linear and nonlinear vibration.
- 2. Responsible for teaching undergraduate and graduate courses in systems and dynamics (ME 230, ME 373, ME 374, ME 469), vibrations (ME 470, ME 588, ME 589, ME 590), mechanical design (ME 495), and applied mathematics (ME 564, ME 565).
- 9/08 3/12: **Graduate Program Coordinator**, Department of Mechanical Engineering, University of Washington, Seattle, WA.
 - 1. Responsible for graduate student affairs including recruitment, evaluation, retention, daily operation, staff management, resolution of conflicts, seminar and qualifying exam coordination, proposal writing (e.g., scholarships and internal grants), student exchanges, marketing, web site development, and interaction with Graduate School.
 - 2. Major achievements:

- A. Departmental graduate program ranking ascended from 31 (2009 publication) to 24 (2013 publication) nationally according to *US News Best Graduate School Rankings*.
- B. Grew ME PhD program from 70 students to 100 students, and expanded ME graduate program enrollment from 200 to 250 students.
- C. Instituted direct PhD program and multi-year financial assistance offers to recruit exceptional PhD students.
- D. Wrote internal proposals to secure funds for recruiting and retaining graduate students. Successful outcomes includes: 3 rounds of diversity fellowship (2 award recipients and one alternate award recipient), 1 Ford Motor Fellowship, 1 Stamps Fellowship, 45 quarters of international tuition waivers, 8 quarters of research assistantship.
- E. Revamped graduate program web sites, such as admission, qualifying exam policy, seminars, and Master of Science Engineering.
- 9/96 9/02 **Associate Professor**, Department of Mechanical Engineering, University of Washington, Seattle, WA.
- 12/93 9/96 **Assistant Professor**, Department of Mechanical Engineering, University of Washington, Seattle, WA.
- 7/94 9/94 **Summer Fellowship Recipient**, Phillips Laboratory, AFOSR, Albuquerque, NM.
- 8/91 12/93 **Assistant Professor**, Department of Engineering Mechanics, University of Nebraska, Lincoln, NE.

SPONSORED RESEARCH

- National Science Foundation, Coupled Dynamics Between Flapping Wings and Vibrating Thorax During Insect Flight, CMMI-1360590, Dynamical Systems Program A. \$ 257,707, 8/1/2014-7/31/2017, PI: I. Y. Shen.
- 2. <u>Boeing Company</u>: Layer Manufacturing of PZT-Silane Nanocomposites, \$70,000, 1/1/14 12/31/14, PI: I. Y. Shen, co-PI: Guozhong Cao.
- 3. <u>Joint Center for Aerospace Technology Innovation (JCATI)</u>: *Development of Lead Zirconate Titanate (PZT)-Silane Nano-Composite Thin Film Sensors*, \$57,374, 7/1/13 6/30/14, PI: I. Y. Shen, co-PI: Guozhong Cao.
- 4. <u>Boeing Company</u>: *Layer Manufacturing of PZT-Silane Nanocomposites*, \$79,957, 4/1/13 12/31/13, PI: I. Y. Shen, co-PI: Guozhong Cao.
- National Science Foundation, Development of PZT Thin-Film Microactuators for Intracochlear Applications, CBET-1159623, General & Age Related Disabilities Engineering (GARDE) Program A. \$ 312,604, 9/1/2012-8/31/2015, PI: I. Y. Shen, co-PIs: Guozhong Cao and Clifford R. Hume. B. \$ 6,000, 9/1/2014-8/31/2015, Research for Undergraduate Experience.
- 6. <u>Boeing Company</u>: Layer Manufacturing of PZT-Silane Nanocomposites, \$109,096, 3/1/12 11/30/12, PI: I. Y. Shen, co-PI: Guozhong Cao.
- 7. <u>Boeing Company</u>: *Layer Manufacturing of PZT-Silica Nanocomposites*, \$61,005, 3/16/11 11/30/11, PI: I. Y. Shen, co-PI: Guozhong Cao.
- 8. <u>National Science Foundation</u>, *Vibration Analysis and Health Diagnosis of Spinning Cyclic Symmetric Rotors with Flexible Bearing and Housing Supports*, CMMI-0969024, Dynamical Systems Program

- A. \$159,858, 9/1/2010-8/31/2014, PI: I. Y. Shen
- 9. <u>National Science Foundation</u>, *Bio-Inspired Inner-Ear Microphones via a Piezoelectric Substrate and Nanorods*, CMMI-1030047, Sensor and Sensor Technology Program
 - A. \$199,836, 7/1/2010-6/30/2014, PI: I. Y. Shen
 - B. \$6,000, 3/16/2011-12/15/2012, Research for Undergraduate Experience, student: McKenzie Staley.
- 10. <u>Boeing Company</u>: Layer Manufacturing of PZT-Silica Nanocomposites, \$61,000, 5/1/10 11/30/10, PI: I. Y. Shen, co-PI: Guozhong Cao.
- 11. <u>National Science Foundation</u>, *Performance Enhancement of PZT Thin-Film Microactuators via a Multi-Scale*, *Multi-Domain Design*, CMMI-0826501, Sensor and Sensor Technology Program
 - A. \$239,925, 7/01/2008-6/30/2012. PI: I. Y. Shen, co-PI: Guozhong Cao
 - B. \$6,000, 9/16/2008-6/30/2009, Research for Undergraduate Experience, Student: Alexia Fisher
 - C. \$6,000, 12/16/2009-6/30/2010, Research for Undergraduate Experience, Student: Alicia Tan
 - D. \$6,000, 09/16/2010-6/30/2011, Research for Undergraduate Experience, Student: Cassius Elston
- 12. <u>National Science Foundation</u>, A Workshop for NSF "Cyber-Enabled Discoveries and Innovations" Initiative in Conjunction with 2007 ASME International Mechanical Engineering Congress & Exhibition, CMMI- 0803484, \$43,761, 11/1/2007-2/28/2009.
- 13. <u>Matsushita Electric Industries</u>: *Vibration Analysis of Fluid-Bearing Spindles*, \$164,000, 1/16/03 1/15/09.
- 14. Hitachi: Vibration of Rotating Disks in Air and in Vacuum, \$35,000, 1/1/2007-12/31/2007.
- 15. <u>National Science Foundation</u>, *Vibration Control of Rotordynamics Using Motors*, CMS-0408777, PI: Brian Fabien, \$218,131, 7/1/2004-6/30, 2007, (Shen's effort is 25%.)
- 16. Western Digital Corporation: Spindle Dynamics of High-RPM and High-TPI Drives, \$240,000, 9/16/99 12/15/06.
- 17. <u>University of Washington Royal Research Fund Award:</u> Feasibility Study of Hybrid Cochlear Implants, \$33,889, 6/16/2005-6/15/2006. PI: I. Y. Shen, Co-PI: C. R. Hume and G. Z. Cao.
- 18. <u>National Science Foundation</u>, A Unified Approach to Analyze Vibration of Rotating Flexible Structures, CMS-0244116.
 - A. \$186,753, 7/1/2003 to 6/31/2006, Dynamics and Control Program
 - B. \$6,000, 9/16/2003-6/15/2004, Research for Undergraduate Experience, Student: Jessica Bowen
 - C. \$6,000, 9/16/2004-6/15/2005, Research for Undergraduate Experience, Student: Melinda Herrin
- 19. Hitachi: Vibration of Disk/Spindle Systems with Flexible Base Plates, \$60,000, 12/00-12/03.
- 20. <u>National Science Foundation</u>: *Taming Vibration of Rotating Disk/Spindle Systems*, Grant No. CMS-9820745.
 - A. \$150,888, 9/15/99 8/31/02, Dynamics and Control Program
 - B. \$10,000, 12/16/99-12/15/00, Research Experiences for Undergraduates (REUs)
 - C. UW matching fund: \$10,000.
- 21. IBM Graduate Fellowship:
 - A. \$22,000, 9/16/01-9/15/02, recipient: Jr-Yi Shen
 - B. \$40,000, 9/16/98 9/15/00, recipient: Jessica Yellin.
- 22. IDEMA Graduate Fellowship: \$5,000, 12/16/00-3/15/01, recipient: Baekho Heo.

- 23. <u>Electro-Mechanic Technology Advancing Foundation</u>, MITI, Japan (via NSK Ltd., Japan): *Vibration Analysis of Spindle Motors with Hydrodynamic Bearings*, \$11,450, 3/15/99-9/15/00.
- 24. <u>IBM Partnership Award</u>: Vibration of Spinning Disk/Spindle Systems for High-TPI and High-RPM Drives, \$20,000, 7/1/98-6/30/99.
- 25. <u>Army Research Office</u>: *Surface Damping Treatments: Innovation, Design, and Analysis*, Agreement No. DAAG55-98-1-0387, \$240,000, 6/1/98 to 5/31/01; co-PI: Professor Per G. Reinhall of UW.
- 26. <u>National Science Foundation</u>: Characterization of Disk/Head Interfacial Contact through System Dynamics and Microelectricalmechanical Sensors, Grant No. CMS-9800180.
 - A. \$300,000, 3/16/98 to 3/15/01, split with co-PI Professor Liwei Lin (University of California, Berkeley, Associate Director, Sensor and Actuator Laboratory)
 - B. \$5,000, 12/16/98 to 6/15/99, Research Experiences for Undergraduates (REUs)
- 27. Seagate Technology: Vibration of Glide Heads with Piezoelectric Sensors, \$20,000, 3/98.
- 28. <u>National Science Foundation</u>: A Nontraditional Vibration Analysis of Rotating Disk/Spindle Systems and Its Applications to Computer Hard Disk Drives, Grant No. CMS-9634557.
 - A. \$149,830, 9/1/96 to 8/31/99, Dynamics and Control Program
 - B. \$5,000, 9/16/98 6/15/99, Research Experiences for Undergraduates (REUs)
 - C. \$5,000, 12/16/99 6/15/00, Research Experiences for Undergraduates (REUs)
- 29. Alcoa Foundation: Vibration of Rotating Disk/Spindle Systems, \$10,000, 7/97-6/98.
- 30. <u>National Science Foundation</u>: *Intelligent Constrained Layer Treatments -- An Innovative Approach*, Grant No. MSS-9496149, \$149,852, 1/94-12/98.
- 31. Royalty Research Fund, University of Washington: Applications of Self-Sensing Active Constrained Layer Damping Treatments, \$20,000, 2/1/96 to 12/31/97.
- 32. Conner Peripherals: Vibration of Next-Generation Disk Drives, \$39,900, 6/15/95 to 6/30/96.
- 33. <u>Air Force Office of Scientific Research</u>: *Active Constrained Layer Damping Treatments*, 1994 Summer Faculty Fellowship, 7/94-9/94.
- 34. <u>Research Support Allocation</u>, University of Washington: \$32,902 for a laser vibrometer with Professors Foster, Fabien, Ramulu, and Reinhall.

SOFTWARE LICENSE & REGISTRATION

- 1. HDAVAP v. 2.0 (Disk/Spindle Vibration Analysis Program), University of Washington, 1998, contributor: I. Y. Shen. Licensees: NSK Ltd. (Japan), SAE Magnetics (Milpitas, CA.).
- 2. HDD Spindle Motor Vibration Analysis Program, University of Washington, 2005, contributors: Jr-Yi Shen and I. Y. Shen. Licensee: Hitachi Ltd. (Japan) at 2005, Samsung Electronics (Korea) at 2006, Data Storage Institute (Singapore) at 2008, and Panasonic Shikokou, Ltd. (Japan) at 2009.

STUDENT SUPPORT

1. Have secured student support from industry through intern positions.

Name	Duration	Source	Amount

Tsung-Liang Wu	10/06-2/07	Western Digital (San Jose, CA.)	\$25,000
Jungkeun Yoon	7/02-9/02	Western Digital (San Jose, CA.)	\$15,000
Jr-Yi Shen	7/01-8/01	IBM (San Jose, CA.)	\$10,000
Richard Kent	7/01-9/01	Seagate (Bloomington, MN.)	\$9,600
Baekho Heo	9/00-12/00	Western Digital (San Jose, CA.)	\$15,000
Paul Chang	7/00-9/00	Seagate (Fremont, CA.)	\$10,000
T. Jintanawan	7/00-9/00	Western Digital (San Jose, CA.)	\$15,000
Jr-Yi Shen	6/00-9/00	IBM (San Jose, CA.)	\$15,000
Chaw-Wu Tseng	10/99-6/00	Western Digital (San Jose, CA.)	\$41,000
Chaw-Wu Tseng	6/99-9/99	Seagate (Oklahoma City, OK.)	\$13,500
Jr-Yi Shen	6/99-9/99	IBM Almaden (San Jose, CA.)	\$15,000
Shalom Ruben	6/99-9/99	Seagate (Longmont, CO.)	\$9,000
Jin-Hui Ou-Yang	1/99-8/99	Seagate (Fremont, CA.)	\$32,000
Jung Seo Park	10/98-12/98	Seagate (Bloomington, MN.)	\$12,000
Jr-Yi Shen	6/98-9/98	IBM (San Jose, CA.)	\$12,000
Baekho Heo	6/98-9/98	Seagate (Fremont, CA.)	\$12,000
Alex Tsay	6/97-3/98	Seagate (Fremont, CA.)	\$36,000
Matt Shumway	6/96-9/96	Seagate (Scotts Valley, CA.)	\$12,000

INDUSTRIAL SHORT COURSES

A. Disk/Spindle Dynamics for Computer Hard Disk Drives.

- 1. 2005, 8/9-10, Samsung Electronics, Suwon, South Korea.
- 2. 2004, 10/25-26: Xyratex, Havant, United Kingdom.
- 3. 2004, 3/25-26: Maxtor Corporation, Shrewsbury, MA.
- 4. 2003, 7/28-29: Maxtor Corporation, Longmont, CO.
- 5. 2002, 11/11-12: Maxtor Corporation, Milpitas, CA.
- 6. 2002, 9/19-20: Maxtor Corporation, Shrewsbury, MA.
- 7. 2002, 6/24-25: Maxtor Corporation, Longmont, CO.
- 8. 2002, 4/25-26: Seagate Technology, Longmont, CO.
- 9. 2002, 3/21-22: Maxtor Corporation, Shrewsbury, MA.
- 10. 2001, 11/29-30: Maxtor Corporation, Milpitas, CA.
- 11. 2001, 9/20-21: Maxtor Corporation, Shrewsbury, MA.
- 12. 2001, 7/16-17: Maxtor Corporation, Longmont, CO.
- 13. 2001, 3/22-23: Quantum Corporation, Shrewsbury, MA.
- 14. 2000, 7/11: Quantum Corporation, Milpitas, CA.
- 15. 2000, 7/17: 29th Annual Symposium, Incremental Motion Control Systems and Devices.
- 16. 2000, 8/29: Hitachi Corporation, Odawara, Japan.
- 17. 2000, 9/14-9/15: Quantum Corporation, Shrewsbury, MA.
- 18. 2000, 11/30-12/1: Quantum Corporation, Milpitas, CA.

- 19. 1999, 3/23: Quantum Corporation, Milpitas, CA.
- 20. 1999, 3/26: Seagate Technology, Oklahoma City, OK.
- 21. 1999, 5/6: Seagate Technology, Longmont, CO.
- 22. 1999, 5/13: Maxtor Corporation, Longmont, CO.
- 23. 1999, 6/7: Seagate Technology, Bloomington, MN.
- 24. 1999, 6/22: Quantum Corporation, Shrewsbury, MA.
- 25. 1999, 7/26: 28th Annual Symposium, Incremental Motion Control Systems and Devices.
- 26. 1999, 8/30-8/31: Quantum Corporation, Milpitas, CA.
- 27. 1998, 7/23: 27th Annual Symposium, Incremental Motion Control Systems and Devices.
- 28. 1998, 11/11: Quantum Corporation, Shrewsbury, MA.

INVENTION DISCLOSURES

- 1. Henry Bittner and I. Y. Shen: Tuned Air Bearing Damping Device for Vibration Reduction of Plate-like Structures, OTT Ref#2131-2960.
- 2. Liwei Lin, I. Y. Shen, and C. -P. Roger Ku: MEMS Sensors for Disk/Head Interfacial Contacts Characterizations, OTT Ref#2392-3022.
- 3. I. Y. Shen and Guozhong Cao: Extra-Sensitive PZT-Based Mechanical Transducers Using Nanorods, OTL Ref# 2799-3905, disclosed on February 21, 2003.
- 4. I. Y. Shen and Guozhong Cao: Extra-Sensitive Biological and Chemical Sensors Using Nanorods, OTL Ref# 2799-3906, disclosed on February 21, 2003.
- 5. I. Y. Shen and Guozhong Cao: Micromixers Using Nanorods, OTL Ref# 2799-3904, disclosed on February 25, 2003.
- 6. Chaw-Wu Tseng, Jr-Yi Shen, and I. Y. Shen: A Unified Algorithm to Compute Vibration of Rotating Machines, disclosure number 3933, disclosed on March 5, 2003; provisional patented filed on March 27, 2003.
- 7. I. Y. Shen: A Unified Algorithm to Compute Vibration of Asymmetric Rotating Machines, OTL Ref#: 3059-4042, disclosed filed in October 2003, provisional patent file in November 2003.
- 8. Clifford Hume, I. Y. Shen, and Guozhong Cao: Hybrid Cochlear Implants, UW TechTransfer DL Reference No. 4146, disclosed on March 2, 2004.
- 9. Clifford Hume and I. Y. Shen: Active Incudo-Stapedial Prosthetic Joints, UW TechTransfer Reference No. 7092D, disclosed on August 4, 2004.
- 10. Hsien-Lin Huang, Guozhong Cao, Naji Al Dahoudi, and I. Y. Shen, "Methods to Make Lead-Zirconium-Titanium Oxide (PZT) Ink," provisional patent filed on July 10, 2012 with serial number 61/669,986

PATENTS

- 1. I. Y. Shen, Chaw-Wu Tseng, Jr-Yi Shen, United States Patent No. 7,630,869, issued on December 8, 2009, "Method for predicting vibrational characteristics of *rotating* structure."
- 2. Jeff Duce, Scott Johnston, I. Y. Shen, G. Z. Cao, Hsien-Lin Huang, "Method and System of Fabricating PZT Nanoparticle Ink Based Piezoelectric Sensor. United States Patent No. 8,614,724, issued on December 24, 2013.

3. Hsien-Lin Huang, G. Z. Cao, I. Y. Shen, "Methods for forming Lead Zirconate Titanate Nanoparticles," U.S. Patent Number 9,005,465, issued on April 14, 2015.

PROFESSIONAL CONSULTING ACTIVITIES

- 1. <u>Kirkland and Ellis (Chicago, IL)</u>, 08/2016-present: retained as an expert witness on arbitration matters related to a patent involving computer interface devices.
- 2. Nakanishi Inc. (Japan), 06/2016-present: consultant on dental and medical products.
- 3. <u>Thomson Reuters Expert Witness Services</u>, 12/2012-present: expert witness on a patent case involving rotary mechanics of optical drives for LG. Major duties include technical analyses, an expert report, and deposition for IPR. (References: Jason M. Shapiro and Brian Tollefson).
- 4. <u>Kelly, Goldfarb, Huck & Roth, PLLC</u> (Seattle, WA) for *Ramgen Power Systems, LLC v. Agilis Engineering, Inc.*, 01/2014-10/2014: retained as an expert witness for litigation matters related to failure of a turbo machinery test rig. Major duties include technical analyses, an expert report, deposition, and testifying in US District Court at Seattle. (References: Kith Roth, Chris Huck, and Michael Goldfarb)
- 5. <u>Industrial Technology Research Institute (Taiwan)</u>, 04/2012-12/2013: consultant on system modeling, robotics, sensors, actuators, and piezoelectric devices.
- 6. TDK (Japan), 01/2010-09/2015: consultant on piezoelectric thin-film devices.
- 7. <u>Intelligent Management Solutions</u> (Denver, CO.): 12/2012–03/2013: expert consultant for disk drive head and disk testers for Guzik vs. Western Digital Corporation.
- 8. <u>Lane Powell</u> (Seattle, WA) for *Hayes vs. Marlow Yachts Limited Inc.*, 01/2011-05/2011: retained as a consulting expert.
- 9. <u>Kirkland and Ellis</u> (New York, NY), 03/2011: technical analysis for potential litigation matter, (reference: Andrew G. Heinz).
- 10. <u>Silicon Valley Expert Witness Group</u>, 04/2010-06/2010: expert consultant on disk drive actuators, shock sensors, and servos.
- 11. <u>Amster, Rothstein, and Ebenstein</u> (New York, NY) for *Nidec vs. JVC*, 03/2005-12/2007: retained as a testifying expert in patent infringement litigations involving disk drive spindle motors. Major duties include technical advice, depositions, written reports, and court tutorial for litigation, (reference: Charley Macedo).
- 12. <u>Intelligent Management Solutions</u> (Denver, CO.): expert consultant for disk drive spindle motors, February to December 2004.
- 13. <u>Seagate Technology</u> (Longmont, CO.): consultant on spindle motors, May 2000, April 2001, May 2002.
- 14. Universal Avionics Systems Corporation (Redmond, WA.): consultant on acoustics, 12/00-1/01.
- 15. Midwest Dental Products (Des Plaines, IL.): consultant on spindle dynamics, 3/00 6/00.
- 16. SAE Magnetics (Beaverton, OR.): consultant on spindle motors, February 1998.

ACADEMIC ADVISING ACTIVITIES

A. Postdoctoral Fellows (Total 2):

- 1. Dr. Chuan Luo, 01/2013 07/2013. Conducted animal tests of PZT thin-film microactuators.
- 2. Dr. Wei Che Tai, 11/2014 07/2016. Conducted research added mass, snap-through of PZT microactuators, and nondestructive testing of dental implants.

B. Current PhD Students (Total 4):

- 1. Ms. Weiwei Xu, ME PhD student, admitted in Autumn 2013. Thesis research: Piezoelectric Nano-Composite thin-film sensors using lead-zirconate-titanate nano-particles.
- 2. Mr. Yifeng Liu, ME PhD student, admitted in Autumn 2013. Thesis research: PZT thin-film microactuators for intracochlear applications.
- 3. Mr. Mark Jankauski, ME, PhD student, admitted in Spring 2014. Thesis research: Coupled Dynamics Between Flapping Wings and Vibrating Thorax During Insect Flight.
- 4. Mr. Sergiy Taylakov, ME, PhD student, admitted in Autumn 2015. Thesis research: Vibration of Microactuators in aqueous environments.

C. Current MS Students with Thesis (Total 0):

D. Former PhD Students (Total 19):

- 1. Mr. Hsin-Chih Ping, PhD, ME, graduated 12/97. Thesis Title: Vibration of Euler-Bernoulli beams containing an oblique crack (currently associate professor of Chung-Cheng Institute of Technology, Taiwan).
- 2. Mr. Yeun-Seuk Jeung, PhD, AA, graduated 6/98. Thesis Title: A finite element formulation of constrained layer damping treatments for shells, (currently senior manager of Korean Aerospace Industries, LTD, Seoul, Korea).
- 3. Ms. Thitima Jintanawan, PhD, ME, graduated 5/00. Thesis Title: Free and forced vibration of rotating disk/spindle systems supported by fluid-film bearings, (currently senior lecturer in Chulalongkorn University, Thailand).
- 4. Mr. Yao-Hsing (Peter) Huang, PhD, ME, graduated 9/00. Thesis Title: Some fundamental issues of constrained layer damping treatments, (currently mechanical engineer in Western Digital Corporation).
- 5. Mr. Jr-Yi Shen, PhD, ME, graduated 6/02. Thesis Title: Effect of base plate flexibility on vibration of disk/spindle systems, (currently mechanical engineer in Hitachi Global Storage Technologies).
- 6. Mr. Chaw-Wu Tseng, PhD, ME, graduated 8/02. Thesis Title: Theoretical and experimental study of hydrodynamic spindles: rotating-shaft design, (currently mechanical engineer at Western Digital Corporation).
- 7. Mr. Jung Seo Park, ME, PhD, graduated 6/03. Thesis Title: Effects of asymmetry on rotating disk and spindle systems, (currently at Hitachi Global Storage Technologies).
- 8. Mrs. Yi-Chu Hsu, ME, PhD, graduated 6/03. Thesis Title: Passive and Active Damping Treatments for Microstructures, (currently assistant professor of Southern Taiwan Institute of Technology.)
- 9. Ms. Jessica Yellin, ME, PhD, graduated 6/04. Thesis Title: Vibration analysis of passive standoff constrained layer damping treatments, supported in part by IBM fellowship and ARO grant DAAG55-98-1-0387.

- 10. Mr. Behko Heo, ME, PhD, graduated in 6/04. Thesis Title: Enclosure design of high-speed rotating disk/spindle systems: aerodynamic and structural considerations, supported in part by IDEMA Fellowship, NSF grant CMS-9820745, and Western Digital interns, (currently at Samsung Electronics).
- 11. Mr. Chia-Che Wu, ME, PhD, graduated in 6/06. Thesis Title: Development of PZT Thin-Film Microactuators, (currently Assistant Professor of Chung-Hsing National University, Taiwan.)
- 12. Mr. Jungkeun Yoon, ME, PhD graduated in June 2008. Thesis Title: Vibration of Rotating Disk/Spindle Systems with Nonlinear Bearings.
- 13. Tsung-Liang Wu, PhD in ME, graduated in December 2008. Thesis research: Vibration Analysis of a Data Storage Device Consisting of a Spinning Disk-Spindle Assembly, a Stationary Housing, and a Swinging Flexible Structure Assembly.
- 14. Cheng-Chun (Ryan) Lee, PhD in ME, graduated in March 2009. Thesis Title: Development of PZT Thin-Film Membrane Actuators.
- 15. Hyunchul Kim, PhD in ME, graduated in June 2009. Thesis Title: Vibration of Spinning Asymmetric Rotors.
- 16. Mr. Qing Guo, PhD in ME, graduated in August 2012. Thesis Title: Development of Thin-Film Based Microdevices and Process Enhancement for Making the Same.
- 17. Mr. Chuan Luo, PhD in ME, graduated in December 2012. Thesis Title: PZT Thin Film Micro Probe Device with Dual Top Electrodes.
- 18. Mr. Wei-Che Tai, ME PhD student, graduated in June 2014. Thesis Title: Vibration of a spinning, cyclic symmetric rotor Assembled to a flexible housing via multiple bearings.
- 19. Ms. Ya-Fang Chen, ME, PhD, graduated in June 2016. Thesis research: Effects of bearings on vibration of cyclic symmetric rotors with mistune.

E. Former MS Students with Thesis (Total 15):

- 1. Mr. Yingdong Song, MSEM, graduated 11/93. Thesis title: Stability and vibration of a rotating circular plate under stationary in-plane edge loads (currently in Centurion Internation, Lincoln, NE).
- 2. Mr. Weili Guo, MSEM, graduated 5/94. Thesis title: Torsional vibration control of a circular shaft through intelligent constrained layer damping treatments (currently in ALMO Manifold & Tooling, Warren, MI).
- 3. Mr. Robert Hildebrand, MSEM, graduated 5/94. Thesis title: Hybrid damping of transverse beam vibration by an in-plane treatment (currently in Institute for Farkostteknik, Stockholm, Sweden).
- 4. Mrs. Carina Ting, MSME, graduated 12/95. Thesis Title: Solutions to the vibration-acoustic response of strip structures subjected to various excitations (previously supported in part by NSF grant MSS-9496149; currently in Cambridge Acoustical Associates, Cambridge, MA).
- 5. Mr. Paul Brown, MSME, graduated 8/96. Thesis Title: Self-sensing active constrained layer damping of a nonlinear beam (previously supported by Royal Research Fund; currently manager of Adroit Systems, Seattle, WA).
- 6. Ms. Jessica Yellin, MSME, graduated 8/96. Thesis Title: An experimental analysis of a self-sensing active constrained layer damping treatment (previously supported by NSF grant MSS-9496149; currently in UW PhD Program).

- 7. Mr. Matt Shumway, MSME, graduated 6/97, Thesis Title: An Experimental Study of Damping in a Rotating Disk and Spindle System, (previously supported by Conner Peripherals and NSF grant CMS-9634557; currently in Seagate Technology, Bloomington, MN.).
- 8. Mr. Alex Tsay, MSME, graduated 6/98. Thesis Title: Theoretical and experimental analysis of vibration characteristics of glide heads for computer hard disk drives, (previously supported in part by Seagate intern and co-op; currently in Western Digital Corporation, San Jose, CA).
- 9. Mr. Henry Bittner, MSME, graduated 8/98. Thesis Title: The effect of air on disk drive dynamics and the taming of disk drive vibration, (previously supported in part by NSF grant CMS-9634557, currently in Response Dynamics, Oakland, CA.).
- 10. Mr. Behko Heo, MSME, graduated 3/99. Thesis Title: Experimental investigation of disk/spindle systems with laminated disks, (previous supported in part by Seagate intern, currently in UW PhD program).
- 11. Ms. Jin-Hui Ou-Yang, MSME, graduated 9/99. Thesis Title: Frequency response functions of PZT glide heads, (previously supported by NSF grant CMS-9800180 and in part by Seagate intern; currently in Western Digital Corporation, San Jose, CA.).
- 12. Mr. Seungman (Paul) Chang, MSME, graduated 6/00. Thesis Title: Disk/head interfacial contacts in glide tests, (previously supported by NSF grant CMS-9800180; currently in Western Digital Corporation, San Jose, CA.).
- 13. Mr. Richard Kent, ME, graduated 6/02. Thesis Title: Response of rotating disk/spindle systems subjected to rocking excitations. Currently at Xerox Corporation.
- 14. Mr. Hyunchul Kim, ME, graduated 6/03. Thesis Title: Verification of a unified rotordynamics analysis by use of rotating cylinders.
- 15. Mr. Mark Jankauski, ME, graduated in 06/14. Thesis research: Coupled Dynamics Between Flapping Wings and Vibrating Thorax During Insect Flight.

F. Former and Current Undergraduate Researchers (Total 16):

- 1. Mr. Clint VanderGiesen, ME, undergraduate senior. Research topic: Effect of ball bearing defects on rocking vibration of rotating disk and spindle systems (supported by NSF grant CMS-9820745).
- 2. Ms. Wina Wichienwidhtaya, ME, graduated 6/01. Research topic: Vibration isolation of rotating disk/spindle systems through damped spacers (supported by NSF grant CMS-9820745), 12/16/99-3/15/00 and 9/16/00-12/15/00.
- 3. Mr. Jason Dahlem, ME, graduated 6/00. Research topic: Frequency response of rotating disk/spindle systems subjected to rocking excitations (supported by NSF grant CMS-9820745), 3/16/00-6/15/00.
- 4. Mr. Richard Kent, ME, graduated 3/00. Research topic: Vibration isolation of rotating disk/spindle systems (supported by NSF grant CMS-9820745), 12/16/99-3/15/00.
- 5. Mr. Shalom Ruben, ME, undergraduate senior. Research topic: Instrumentation and testing of spindle systems at elevated temperature (supported by REU of NSF grant CMS-9634557), 9/16/98-6/15/99.
- 6. Ms. Monica Williams, ME, undergraduate senior. Research topic: Instrumentation of impact force hammer for disk drive applications (supported by REU of NSF grant CMS-9800180), 12/16/98-6/15/99.

- 7. Ms. Jessica Bowen, ME, undergraduate senior. Research topic: Experimental and theoretical study of spinning cylinder mounted on hydrodynamic spindle motors (supported by REU of NSF grant CMS-0244116), 9/16/2003-6/15/2004.
- 8. Ms. Melinda Herrin, ME, undergraduate senior. Research topic: Experimental and theoretical study of spinning cylinder mounted on hydrodynamic spindle motors (supported by REU of NSF grant CMS-0244116), 9/16/2004-6/15/2005.
- 9. Mr. Nicholas Colonnese, ME, undergraduate senior. Research topic: Waterfall plot measurements of a spinning cyclic symmetric rotor on flexible bearings. 6/16/08-8/31/08. Intel REU.
- 10. Ms. Alexia Fisher, ME, undergraduate senior. Research topic: Effects of electrode arrangements in PZT thin-film sensors and actuators. 9/16/08-6/15/2009. NSF REU.
- 11. Alicia Tan, ME, undergraduate senior. Research topic: Fabrication of PZT thin films using calibrated pyrolysis in sol-gel process. 12/16/09-6/15/10. NSF REU.
- 12. Cassius Elston, ME, undergraduate senior. Research topic: Effects of slots on displacement enhancement of PZT thin-film microactuators. 09/16/10-6/15/11. NSF REU.
- 13. Mckenzie Staley, ME undergraduate senior. Research topic: Development of test rigs to calibrate sensitivity of PZT thin-film diaphragm micro-sensors. 6/16/2012-06/15/2013, NSF REU.
- 14. Samuel Wallen, ME undergraduate senior. Research topic: Self-sensing acoustic actuator via a dual-electrode design. 11/16/2012-06/15/2013, NSF hourly.
- 15. Dana I. Fraij, ME undergraduate senior. Research topic: Characterization of a PZT disk bender for tactile sensing. 6/16/2015-9/15/2015. NSF REU.
- 16. Ziwen Guo, ME undergraduate junior. Research topic: dynamics of flapping wings. 9/15/2015-present.

F. ME 499 Special Projects (Total 3):

- 1. Mr. Kim Gerald, Winter Quarter, 1998; design of automatic transmission systems for bicycles.
- 2. Mr. Patrick Dean, Winter and Spring Quarters, 1996; design of disk brakes for bicycles.
- 3. Mr. Richard Chu, Winter and Spring Quarters, 1995; piezoelectric actuators for plates.

TEACHING ACTIVITIES AT UW

A. Undergraduate Courses Taught

- 1. ME 230 -- Kinematics and Dynamics
- 2. ME 373 -- Introduction to System Dynamics
- 3. ME 374 -- System Dynamics Analysis and Design
- 4. ME 470 Mechanical Vibration

B. Graduate Courses Taught

- 1. ME 564 -- Mechanical Engineering Analysis I
- 2. ME 565 -- Mechanical Engineering Analysis II
- 3. ME 588 -- Dynamics and Vibration
- 4. ME 589 -- Vibrations I (Nonlinear Vibration)
- 5. ME 590 -- Vibrations II (Random Vibration)
- 6. ME 599 X -- Damping in Vibratory Systems

C. Curriculum Development and Modification

- 1. Revising curriculum of ENGR 230 (Kinematics and Dynamics) in Autumn 1995 and Spring 1996. Developed pretests and tutorials for cooperative learning in classroom.
- 2. Developed a new graduate course ME 599 X Damping in Vibratory Systems offered in the Spring Quarter of 1995 and 1997. 15 students were enrolled in 1995 and 14 in 1994.

D. Teaching Evaluations – Undergraduate Courses (Out of a 5.0 Scale)

Courses				Evaluations (out of 5.0)	
Number	Name	Year	No. of Students (Respondents)	Instructor's Contribution	Teaching Effectiveness
ME 374	System Dynamics II	Sp 16	158(44)	4.7	4.6
ME 373	System Dynamics I	W 16	153	5.1	5.1
ME 230	Kinematics and Dynamics	W 15	162	5.1	5.0
ME 373	System Dynamics I	W 14	140	4.9	4.7
ME 230	Kinematics and Dynamics	Sp 13	175	4.9	4.7
ME 374	System Dynamics II	Sp 12	123	4.8	4.9
ME 230	Kinematics and Dynamics	Sp 11	162	5.0	5.0
ME 230	Kinematics and Dynamics	Sp 10	159	3.5	3.5
ME 374	System Dynamics II	Sp 08	94	5.1	5.2
ME 373	System Dynamics I	W 08	95	5.0	5.0
ME 230	Kinematics and Dynamics	Sp 07	135	4.8	4.7
ME 374	System Dynamics II	Sp 06	99	5.1	5.1
ME 373	System Dynamics I	W 06	100	4.9	5.0
ME 230	Kinematics and Dynamics	Sp 05	128	4.8	4.8
ME 374	System Dynamics II	Sp 04	53	4.9	4.8
ME 373	System Dynamics I	W 04	70	4.8	4.7
ME 230	Kinematics and Dynamics	Sp 03	161	5.0	5.0
ME 470	Mechanical Vibration	A 02	18	4.50	3.50
ME 230	Kinematics and Dynamics	Sp 02	130	4.30	4.40
ME 470	Mechanical Vibration	A 01	18	4.50	4.19
ME 374	System Dynamics II	W 01	58	4.88	4.85
ME 373	System Dynamics I	A 00	57	4.85	4.80
ME 230	Dynamics	Sp 00	68	4.55	4.41
ME 374	System Dynamics II	W 00	52	4.96	4.83
ME 373	System Dynamics I	A 99	45	4.77	4.67
ME 374	System Dynamics II	Sp 99	35	4.18	4.13
ENGR 230	Kinematics and Dynamics	Sp 98	101	4.67	4.61
ME 374	System Dynamics II	Sp 98	66	4.67	4.39

ME 373	System Dynamics I	W 98	49	4.86	4.87	
ENGR 230	Kinematics and Dynamics	A 97	49	4.79	4.76	
ENGR 230	Kinematics and Dynamics	Sp 97	88	4.86	4.80	
ME 373	System Dynamics I	W 97	58	4.5	4.4	
ENGR 230	Kinematics and Dynamics	Sp 96	Developm	Development – No Evaluation Data		
ENGR 230	Kinematics and Dynamics	A 95	Development – No Evaluation Data			
ENGR 230	Kinematics and Dynamics	W 95	41	4.83	4.78	

E. Teaching Evaluations – Graduate Courses (Out of a 5.0 Scale)

	Courses	Evaluations (out of 5.0)			
Number	Name	Year	No. of Students	Instructor's Contribution	Teaching Effectiveness
ME 588	Dynamics & Vibration	A 15	28	4.9	4.9
ME 588	Dynamics & Vibration	A 14	41	4.5	4.4
ME 588	Dynamics & Vibration	A 13	28	4.5	4.5
ME 589	Vibration I	W 13	11	4.7	4.3
ME 588	Dynamics & Vibration	A 12	37	4.8	4.7
ME 588	Dynamics & Vibration	A 11	7	4.5	4.5
ME 588	Dynamics & Vibration	A 10	30	4.8	4.7
ME 588	Dynamics & Vibration	A 09	22	4.4	4.3
ME 588	Dynamics & Vibration	A 08	10	4.6	4.6
ME 588	Dynamics & Vibration	A 06	17	4.5	4.6
ME 588	Dynamics & Vibration	A 05	20	4.5	4.3
ME 588	Dynamics & Vibration	A 03	13	4.10	3.50
ME 588	Dynamics & Vibration	W 03	18	4.10	4.10
ME 589	Vibration I	W 02	12	4.41	4.39
ME 588	Dynamics & Vibration	A 01	15	4.35	4.15
ME565	Engineering Analysis II	W 99	30	4.86	4.73
ME 564	Engineering Analysis I	A 98	30	4.81	4.34
ME 588	Dynamics & Vibration	A 98	10	4.94	4.88
ME 599X	Vibration Damping	Sp 97	14	4.91	4.69
ME 588	Dynamics & Vibration	A 96	25	4.8	4.7
ME 565	Engineering Analysis II	W 96	29	4.8	4.8
ME 599H	Vibration Damping	Sp 95	9(3)*	5.0(4.67)	4.89(4.67)
ME 588	Dynamics & Vibration	A 94	13	4.75	4.50
ME 590	Vibration II	Sp 94	5(2)*	4.5(3.5)*	4.5(3.5)*
ME 589	Vibration I	W 94	7(2)*	4.86(5.0)*	4.71(5.0)*

^{*} The numbers in parentheses are from distant learning students

F. Collegial Evaluation of Teaching Effectiveness

1. ME 374 – System Dynamics Analysis and Design, Winter Quarter, 2000

Conclusion: There is very little that the committee can add to the foregoing. Professor Shen is clearly a gifted teacher. Although he does not mention it, he has acted as an informal teaching mentor and coach to various faculty who are either new to the University or are attempting changing their teaching. His success in the face of a heavy teaching load and challenging classes is testimonial to his skills and the hard work he devotes to his students.

2. ENGR 230 -- Kinematics and Dynamics, Winter Quarter, 1995

Conclusion: Professor Shen is an effective teacher in both undergraduate and graduate instruction. The overwhelming enthusiasm of the responses by his students indicates that he is a gifted educator.

3. ME 589 -- Vibration I (Nonlinear Vibration), Winter Quarter, 1994

Conclusion: Professor Shen is an effective instructor at the graduate course level. The overwhelming enthusiasm of the responses by his students in the student evaluation indicates that he is a gifted educator. One can only assume on the basis of this single review that he will be as effective in his conduct of undergraduate courses.

PROFESSIONAL SERVICES

A. External Services

- 1. Technical Editor, ASME Journal of Vibration and Acoustics, 3/1/2014-12/31/2019.
- 2. Member of Advanced Research Advisory Committee, Industrial Technology Research Institute, Taiwan, 5/1/2016-4/30/2019.
- 3. Past Chair (10/1/2014-09/30/2016), Chair (10/1/2012-09/30/2014), Vice Chair (7/1/10-9/30/12), Secretary (7/1/08-6/30/10), and Member (7/1/03 6/30/08) of ASME Technical Committee of Vibration and Sound, Design Engineering Division.
- 4. Associate Editor, ASME Journal of Vibration and Acoustics, 6/15/2005-6/14/2012.
- 5. Conference Chair, 2006 ASME/ISPS-JSME/IIP Joint Conference on Micromechantronic Intelligent and Precision Equipment, San Jose, CA., USA, 6/21-23.
- 6. Guest Editor, MIPE 2006 Special Issue, Journal of Microsystem Technologies, MEMS, Systems for Information Storage & Processing.
- 7. Member of the Editorial Board of *Journal of Microsystem Technologies, MEMS, Systems for Information Storage & Processing*, January 2002 present.
- 8. Chair (7/07-6/08), Vice Chair (7/06-6/07) and Executive committee member (7/00 to 6/06) of ASME Information Storage and Processing System (ISPS) Division.
- 9. Review tenure and promotion cases for major research universities including: RPI (2000), Columbia University (2002), University of Maryland (2003), University of Pittsburg (2004), Northeastern University (2005, 2010, 2011), Chinese University of Hong Kong (2006, 2011), University of Illinois-Chicago (2006), Nanyang Technical University, Singapore (2007, 2008), University of Connecticut (2007, 2012), University of Michigan (2007, 2011), University of Washington (2007), University of Waterloo, Canada (2008). University of Tennessee (2010), University of Utah (2010), Stevens Institute of Technology (2010), UCLA (2010), Miami University (2010), Massey University (2010), National Central University (2012).

- 10. Co-organize the following conferences and workshops.
 - Annual Symposium of ASME Information Storage and Processing System (ISPS) Division held at San Jose, CA., from June 2001 to present, (Spindle motor sessions).
 - 3rd Asia-Pacific Magnetic Recording Conference held at Tokyo, Japan, 6-9 November, 2000, sponsored by IEEE and ASME, (Publicity Chair).
 - 2nd Asia-Pacific Magnetic Recording Conference held at Singapore, 29-31 July, 1998, sponsored by IEEE and ASME, (Organizer of Spindle Motor Session).
 - US-Japan Workshop on Smart Structures and Materials held in December 4-5, 1995 at the University of Washington with Professors Taya and Inoue, (Workshop Co-chair).
- 11. Served on the program committee of the following conferences.
 - International Symposium on Smart Structures and Microsystems, 2000, October 19-21, Hong Kong.
 - North American Conference on Smart Structures and Materials -- Passive Damping, 1998-2003
- 12. Review proposals for the following agencies and organizations since 1994.
 - National Science Foundation
 - National Institute of Health
 - Army Research Office
 - Natural Sciences and Engineering Research Council of Canada
 - Science and Engineering Research Council, Agency for Science, Technology and Research, Singapore (ASTAR)
 - Non-profit organizations (e.g., United States Civilian Research and Development Foundation).
- 13. Serve as a reviewer for the following journals from 1991 to present.
 - Sensors and Actuators A Physical
 - IEEE Sensors Journal
 - ASME Journal of Applied Mechanics
 - ASME Journal of Vibration and Acoustics
 - ASME Journal of Tribology
 - ASME Journal of Dynamic Systems, Measurements, and Control
 - IEEE Transaction on Magnetics
 - IEEE/ASME Transaction on Mechatronics
 - AIAA Journal
 - STLE Tribology Transaction
 - Journal of Sound and Vibration
 - Journal of the Acoustical Society of America
 - Journal of Smart Materials and Structures
 - Shock and Vibration Journal
 - International Journals of Solids and Structures
 - Journal of Vibration and Control
 - Journal of Intelligent Materials, Systems, and Structures
 - Journal of Information Storage and Processing Systems
- 14. Serve as session chairmen of various ASME, IEEE, SPIE meetings since 1992. For example,
 - Spindle and actuator Session, ASME Information Storage and Processing System (ISPS) Conference, Santa Clara, CA., June 1999-2006, Sponsor by ASME.
 - Spindle Motor Session, 2nd Asia-Pacific Magnetic Recording Conference, Singapore, July 29-31, 1998, sponsored by IEEE and ASME.

B. Internal Services

- 1. Serve as the faculty Advisor of UW ASME Student Chapter, April 1997 to present.
- 2. Review proposals for Royal Research Funds.
- 3. Served on the following assignments of College of Engineering:
 - Councils on Education Policies: 9/06-6/07
 - COE Open House: ME faculty coordinator, 1996
 - Student Affair Committee, 1999, vice chair.
 - COE restructuring, "Research and Facility" tiger team, 1999.
- 4. Serve on the following assignments of ME Department:
 - Strategic Planning Committee, 1999
 - Image Committee, 1999-present.
 - Faculty Search Committee: 1999 (Cooper), 1997 (Bill Amstrong), 2011 (Jonathan Posner).
 - SD&D Group Coordinator, 1997-1999, 2007-2009.
 - Undergraduate admission and scholarship committee, 1997-2007 (chair).
 - CETE (Collegial Evaluation of Teaching Effectiveness) Committee, 1996-present.
 - Undergraduate Education Committee, 1995-1996 (member), 2001-2007 (chair).
 - Graduate Program Coordinator, 09/2008-03/2012.
 - Promotion Advisory Committee, 2007-2010.

HONORS AND AWARDS

- 1. 2017: N. O. Myklestad Award, American Society of Mechanical Engineers
- 2. 2014: Best Paper Award, International Micro Air Vehicle Conference and Competition, Delft, The Netherlands, August 12-15, 2014, https://www.youtube.com/watch?v=S64kXAaT4IU
- 3. 2009: Valued Reviewer, Sensors and Actuators A -- Physical
- 4. 2008: Fellow, American Society of Mechanical Engineers
- 5. 2007: Distinguished Guest, Data Storage Institute, Singapore
- 6. 2004: ME Outstanding Faculty of the Year Award
- 7. 2003: ME Outstanding Faculty of the Year Award
- 8. 1998: ME Outstanding Faculty of the Year Award
- 9. 1998: IBM Partnership Award
- 10. 1994: Research Associate of AFOSR Summer Research Program

REFEREED ARCHIVAL JOURNAL PAPERS

- 1. I. Y. Shen and C. D. Mote, Jr., 1991: On the Mechanisms of Instability of a Circular Plate Under a Rotating Spring-Mass-Dashpot System, *Journal of Sound and Vibration*, Vol. 148, No. 2, July 1991, pp. 307-318.
- 2. I. Y. Shen and C. D. Mote, Jr., 1991: Parametric Resonances of a Circular Plate with Inclusions Subjected to a Rotating Spring, *Journal of Sound and Vibration*, Vol. 149, No. 1, pp. 164-169.
- 3. I. Y. Shen and C. D. Mote, Jr., 1992: Parametric Excitation Under Multiple Excitation Parameters: Asymmetric Plates Under a Rotating Spring, *International Journal of Solids and Structures*, Vol. 29, No. 8, 1992, pp. 1019-1032.

- 4. I. Y. Shen and C. D. Mote, Jr., 1992: Dynamic Analysis of Three-Dimensional, Finite, Linear, Elastic Solids with Kelvin Viscoelastic Inclusions: Theory with Applications to Asymmetrically Damped Circular Plates, *The Journal of the Acoustical Society of America*, Vol. 91, No. 3, March 1992, pp. 1489-1499.
- 5. I. Y. Shen and C. D. Mote, Jr., 1992: Modal Analysis of Kelvin Viscoelastic Solids Under Arbitrary Excitation: Asymmetric Plates Under a Rotating Transverse Force, *The Journal of the Acoustical Society of America*, Vol. 91, No. 5, May 1992, pp. 2703-2707.
- 6. I. Y. Shen and C. D. Mote, Jr., 1992: Dynamic Analysis of Three-Dimensional, Finite, Linear, Elastic Solids Containing Small Elastic Imperfections: Theory with Application to Asymmetric Circular Plates, *Journal of Sound and Vibration*, Vol. 155, No. 3, June 1992, pp. 443-466.
- 7. I. Y. Shen and C. D. Mote, Jr., 1992: Parametric Resonances of an Axisymmetric, Circular Plate Subjected to a Rotating Mass, *Journal of Sound and Vibration*, Vol. 152, No. 3, pp. 573-576.
- 8. I. Y. Shen, 1993: Response of a Stationary, Damped, Circular Plate Under a Rotating Slider Bearing System, *ASME Journal of Vibration and Acoustics*, Vol. 115, pp. 65-69.
- 9. I. Y. Shen, 1993: Vibration of Elastic Structures with Cracks, *ASME Journal of Applied Mechanics*, Vol. 60, pp. 414-421.
- 10. I. Y. Shen, 1993: Perturbative Eigensolutions of Elastic Structures with Cracks, *ASME Journal of Applied Mechanics*, Vol. 60, pp. 438-442.
- 11. I. Y. Shen and C. D. Mote, Jr., 1993: On the Mode Splitting of a Degenerate Elastic Structure with Cracks, *ASME Journal of Applied Mechanics*, Vol. 60, pp. 929-935.
- 12. I. Y. Shen, 1994: Vibration of Rotationally Periodic Structures, *Journal of Sound and Vibration*, Vol. 172, pp. 459-470.
- 13. I. Y. Shen, 1994: Hybrid Damping Through Intelligent Constrained Layer Treatments, *ASME Journal of Vibration and Acoustics*, Vol. 116, pp. 341-349.
- 14. I. Y. Shen, 1994: Bending Vibration Control of Composite and Isotropic Plate Structures through Intelligent Constrained Layer Treatments, *Journal of Smart Materials and Structures*, Vol. 3, pp. 59-70.
- 15. I. Y. Shen, 1995: Vibration of a Three Dimensional, Finite, Linear, Elastic Solid Containing Cracks, *ASME Journal of Applied Mechanics*, Vol. 62, pp. 282-288.
- I. Y. Shen, 1995: Bending and Torsional Vibration Control of Composite Beams Through Intelligent Constrained Layer Damping Treatments, *Journal of Smart Materials and Structures*, Vol. 4, pp. 340-355.
- 17. I. Y. Shen, 1996: Stability and Controllability of Euler-Bernoulli Beams with Intelligent Constrained Layer Treatments, *ASME Journal of Vibration and Acoustics*, Vol. 118, pp. 70-77.
- 18. I. Y. Shen and Y. Song, 1996: Stability and Vibration of a Rotating Circular Plate Under Stationary In-plane Edge Loads, *Journal of Applied Mechanics*, Vol. 63, pp. 121-127.
- 19. C.-P. Roger Ku and I. Y. Shen, 1996: Effect of Disk Flexibility on Rocking Mode Frequencies of a Disk Drive Spindle Motor System, *STLE Tribology Transactions*, Vol. 39, No. 3, pp. 579-586.
- 20. Jessica M. Yellin and I. Y. Shen, 1996: A Self-Sensing Active Constrained Layer Damping Treatment for Euler-Bernoulli Beams, *Journal of Smart Materials and Structures*, Vol. 5, pp. 628-637.

- 21. I. Y. Shen and C. -P. Roger Ku, 1997: A Non-Classical Vibration Analysis of Multiple Rotating Disks/Shaft Assembly, *ASME Journal of Applied Mechanics*, Vol. 64, pp. 165-174.
- 22. I. Y. Shen, 1997: Closed-Form Forced Response of a Damped, Rotating, Multiple Disk/Spindle System, ASME *Journal of Applied Mechanics*, Vol. 64, pp. 343-352.
- 23. I. Y. Shen, 1997: A Variational Formulation, a Work-Energy Relation, and Damping Mechanisms of Active Constrained Layer Damping Treatments, *ASME Journal of Vibration and Acoustics*, Vol. 119, pp. 192-199.
- 24. I. Y. Shen, Weili Guo, and Y. C. Pao, 1997: Torsional Vibration Control of a Shaft through Intelligent Constrained Layer Damping Treatments, *ASME Journal of Vibration and Acoustics*, Vol. 119, pp. 504-511.
- 25. I. Y. Shen, 1997: Active Constrained Layer Damping Treatments for Shell Structures: a Deep Shell Theory, *Journal of Smart Materials and Structures*, Vol. 6, pp. 89-101.
- 26. C. Ting and I. Y. Shen, 1997: Closed Form Solutions to the Vibro-Acoustic Response of Strip Structures, *Journal of the Acoustical Society of America*, Vol. 102, No. 2, pp. 968-978.
- 27. I. Y. Shen, 1998: Some Comments on Rocking Motion of Rotating Disk/Spindle Assembly, *ASME Journal of Applied Mechanics*, Vol. 65, No. 4, pp. 1061-1062.
- 28. B. Heo, H. Bittner, M. L. Shumway and I. Y. Shen, 1999: Identifying Damping of a Gyroscopic System Through the Half-Power Method and Its Applications to Rotating Disk/Spindle Systems, *ASME Journal of Vibration and Acoustics*, Vol. 121, pp. 70-77.
- 29. H. Bittner and I. Y. Shen, 1999: Taming Disk/Spindle Vibrations through Aerodynamic Bearings and Acoustically Tuned-Mass Dampers, *IEEE Transaction of Magnetics*, Vol. 35, No. 2, March, pp. 827-832.
- 30. T. Jintanawan, I. Y. Shen, and C. -P. R. Ku, 1999: Free and Forced Vibration of a Rotating Disk Pack and Spindle Motor System with Hydrodynamic Bearings, *Journal of Information Storage and Processing Systems*, Vol. 1, pp. 45-58.
- 31. S. D. Ruben and I. Y. Shen, 1999: Evaluating Vibration Characteristics of Disk Media Substrate, *Journal of Information Storage and Processing Systems*, Vol. 1, pp. 281-285.
- 32. A. Y. Tsay, J. H. Ou-Yang, C. -P. R. Ku, I. Y. Shen, and D. Kuo, 1999: Free Vibration Analysis of PZT Glide Heads, *ASME Journal of Tribology*, Vol. 121, pp. 984-988.
- 33. J. H. Ou-Yang, A. Y. Tsay, I. Y. Shen, and D. Kuo, 1999: Experimental and Theoretical Studies of PZT Glide Head Vibration, *IEEE Transaction on Magnetics*, Vol. 35, No. 5, pp. 2493-2495.
- 34. B. Heo, I. Y. Shen, and D. Kuo, 1999: Taming Disk and Spindle Rocking by Damped Laminated Disks, *IEEE Transaction on Magnetics*, Vol. 35, No. 5, pp. 2304-2306.
- 35. B. Heo, I. Y. Shen, and J. J. Riley, 2000: Reducing Disk Flutter by Improving Aerodynamic Design of Base Castings, *IEEE Transaction on Magnetics*, Vol. 36, No. 5, pp. 2222-2224.
- 36. J. M. Yellin, I. Y. Shen, P. G. Reinhall, and P. Huang, 2000: An Analytical and Experimental Analysis for a One-Dimensional Passive Stand-Off Layer Damping Treatment, *ASME Journal of Vibration and Acoustics*, Vol. 122, No. 4, pp. 440-447.
- 37. J. H. Ou-Yang, A. Y. Tsay, I. Y. Shen, C. -P. R. Ku, and D. Kuo, 2000: Forced Response of PZT Glide Heads, *ASME Journal of Tribology*, Vol. 122, pp. 780-786.

- 38. I. Y. Shen, 2000: Recent Vibration Issues in Computer Hard Disk Drives, *Journal of Magnetism and Magnetic Materials*, Vol. 209, pp. 6-9.
- 39. D. Kuo, R. Sundaram, R. Thangaraj, J.-H. Ou-Yang, and I. Y. Shen, 2000: Mechanical Performance of Laminated Disks, *IEEE Transaction on Magnetics*, Vol. 36, pp. 166-170.
- 40. I. Y. Shen, 2000: Vibration of Flexible Rotating Disks, *Shock and Vibration Digest*, Vol. 32, No. 4, pp. 267-272.
- 41. T. Jintanawan and I. Y. Shen, 2000: Free Vibration of a Rotating Disk Pack and Spindle Motor System with Rotating Shaft Design, *Journal of Information Storage and Processing Systems*, Vol. 2, pp. 129-139.
- 42. J. Y. Shen, C. W. Tseng, I. Y. Shen, and C. –P. R. Ku, 2000: Vibration of Disk Media at Elevated Temperatures. *Journal of Information Storage and Processing Systems*, Vol. 2, pp. 307-312.
- 43. T. Jintanawa, I. Y. Shen, and K. Tanaka, 2001: Vibration Analysis of Fluid Bearing Spindles with Rotating-Shaft Design, *IEEE Transaction on Magnetics*, Vol. 37, No. 2, pp. 799-804.
- 44. P. Huang, P. G. Reinhall, I. Y. Shen, and J. M. Yellin, 2001: Thickness Deformation of Constrained Layer Damping -- An Experimental and Theoretical Evaluation, *ASME Journal of Vibration and Acoustics*, Vol. 123, pp. 213-221.
- 45. Y. S. Jeung and I. Y. Shen, 2001: Development of an Isoparametric, Degenerate Constrained Layer Element for Plate and Shell Structures, *AIAA Journal*, Vol. 39 (10), pp. 1997-2005.
- 46. P. Huang, P. G. Reinhall, I. Y. Shen, 2001: A Comment on Boundary Conditions in the Modeling of Beams with Constrained Layer Damping Treatments, *ASME Journal of Vibration and Acoustics*, Vol. 123, pp. 280-284.
- 47. P. Huang, P. G. Reinhall, I. Y. Shen, and V. Kumar, 2001: Use of Microcellular Foam Materials in Constrained Layer Damping Treatments. *Journal of Cellular Polymers*, Vol. 20, No. 2, pp. 101-114.
- 48. C. W. Tseng, J. Y. Shen, C. –P. R. Ku, and I. Y. Shen, 2002: Effect of Elevated Temperatures on Rocking Vibration of Rotating Disk and Spindle Systems. ASME *Journal of Tribology*, Vol. 124, pp. 794-800.
- 49. Yi-Chu Hsu and I. Y. Shen, 2002: Constrained Layer Damping Treatments for Microstructures. ASME *Journal of Vibration and Acoustics*, Vol. 124, pp. 612-617.
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- 97. R. D. Manson and I. Y. Shen, "Preliminary Modeling of a Bio-Inspired Piezoelectric Microphone," ASME Seventh International Conference on Micro- and Nanosystems, Portland, OR, August 4-7, 2013, DETC2013-13645.
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- 99. W. C. Tai and I. Y. Shen, "Experimental Verification of Ground-Based Response of a Spinning, Cyclic Symmetric Rotor Assembled to a Flexible Stationary Housing via Multiple Bearings," ASME 26th Conference on Mechanical Vibration and Noise, Buffalo, NY., August 17-20, 2014, DETC2014-34749.
- 100. Y. F. Chen and I. Y. Shen, "Effects of Bearings and Housing on Mode Localization of a Nearly Cyclic Symmetric System," ASME 26th Conference on Mechanical Vibration and Noise, Buffalo, NY, August 17-20, 2014, DETC2014-34536.
- 101. Chuan Luo, Irina Omelchenko, Robert Manson, Carol Robbins, Elizabeth C. Oesterle, G. Z. Cao, I. Y. Shen, Clifford R. Hume, 2015, "Direct Intracochlear Acoustic Stimulation using a PZT Microactuator," Abstracts of 2015 Conference on Implantable Auditory Prostheses, July 12-17, Lake Tahoe, CA. (podium talk).
- 102. Chuan Luo, M. Staley, G. Z. Cao, and I. Y. Shen, "Sensitivity Calibration of a Lead-Zirconate-Titanate (PZT) Thin-Film Intracochlear Microphone," 14th World Congress in Mechanism and Machine Science, Taipei, Taiwan, 25-30 October, 2015.
- 103. M. Jankauski and I. Y. Shen, "Experimental Flapping Wing Strain Prediction using an Inertial-Elastic Model," International Micro Air Vehicle Conference and Competition, Aachen, Germany, September 15-18, 2015.

BOOK CHAPTER

1. I. Y. Shen: An Introduction to Active Constrained Layer Damping Treatments, *Structronic Systems: Smart Structures, Devices, and Systems*, Editors: H. S. Tzou, G. L. Anderson, and M. C. Natori, World Science Publishing Company, Chapter 3, pp. 61-110, 1998, ISBN: 981-02-2955-0.

INVITED LECTURES

- 1. "Self-Sensing Active Constrained Layer Damping Treatments: Modeling, Simulation, and Experiments," University of California, Berkeley, CA., April 1996.
- 2. "Research on Rotating Disk/Spindle Systems at the University of Washington," IBM Almaden Research Center (San Jose, CA.), March 1997.
- 3. "Vibration and Damping Considerations in Computer Hard Disk Drives," 3M (St. Paul, MN.), June 1997.
- 4. "Vibration Control via Constrained Layer Damping: Modeling, Challenges, and Outlooks," IBM Almaden Research Center (San Jose, CA.), February 12, 1998.
- 5. "Disk Drive Spindle Vibration," Hong Kong University of Science and Technology, Hong Kong, China, August 1998.
- 6. "Vibration of Aluminum Disks in Computer Hard Disk Drives," Aluminum Company of America (Alcoa Technical Center, PA.), October 14, 1998.
- 7. "Research on Rotating Disk/Spindle Systems at the University of Washington," Data Storage Research Center, Carnegie Mellon University, (Pittsburg, PA.), October 15, 1998.
- 8. "Damping -- the Last Frontier," First ARO Damping Workshop, Virginia Tech., (Blacksburg, VA.), October 22, 1998.
- 9. "Disk Drive Spindle Dynamics," Hitachi Ltd. (Odawara, Japan), May 27, 1999.
- 10. "Disk Drive Spindle Dynamics and Servo Controls," Control and Robotics Colloquium, UW, April 7, 2000.
- 11. "Opportunities for MEMS in Computer Hard Disk Drives," Center of Applied Microtechnology, UW, April 20, 2000.
- 12. "Vibration of Disk Drive Spindles with Ball or Hydrodynamic Bearings," Colorado Institute of Storage Systems, University of Colorado, Boulder, CO., May 18, 2000.
- 13. "Vibration of Disk Drive Spindles with Ball or Hydrodynamic Bearings," Fujitsu, Kawasaki, Japan, November 10, 2000.
- 14. "Vibration of Rotating Disk and Spindle Systems," University of California, Los Angeles, March 8, 2001.
- 15. "Damping Treatments for Computer Hard Disk Drives," *International Workshop on Passive and Active Damping Directions for the Next Decade*, Neu-Ulm, Germany, June 18-20, 2001.
- 16. "Vibration of Rotating Disk and Spindle systems," Shanghai Jiaotong University, Shanghai, China, August 30, 2002.
- 17. "Leadership through Innovation My Academic Experience," Western Digital Corporation, May 15, 2003.

- 18. "Vibration of HDD Spindle Motors," Keynote speech for 2003 JSME-IIP/ASME-ISPS Joint Conference on Micromechatronics for Information and Precision Equipment, 6/15-18, 2003, Yokohama, Japan.
- 19. "A Unified Algorithm to Analyze Vibration of Rotating Machines," Pratt & Whitney, East Hartford, CT., September 24, 2003.
- 20. "A Unified Algorithm to Analyze Vibration of Rotating Machines," General Electrics Research Center, Schenectady, NY, September 25, 2003.
- 21. "A Unified Algorithm to Analyze Vibration of Rotating Machines," MSC.Software, Pasadena, CA., October 28, 2003.
- 22. "Vibration of Flexible Spinning Asymmetric Rotors," MSC.Software, Pasadena, CA., July 16, 2004.
- 23. "A Unified Algorithm to Analyze Vibration of Rotating Machines," National Cheng-Kung University, Tainan, Taiwan, August 23, 2004.
- 24. "PZT Thin-Film Sensors and Actuators: Applications to Biomedical Engineering," Mayo Clinic, Rochester, MN, September 9, 2005.
- 25. "Electrode Optimization of PZT Thin-Film Microactuators for Hybrid Cochlear Implants," 2007 *Conference on Implantable Auditory Prostheses*, July 15-20, Lake Tahoe, CA.
- 26. "Fundamentals of HDD Spindle Motor Dynamics," Data Storage Institute, Singapore, October 30, 2007.
- 27. "Present and Future Opportunities of HDD Spindle Vibration Research," Data Storage Institute, Singapore, November 1, 2007.
- 28. "PZT Thin-Film Micro-Devices for Biomedical Applications," National Chung-Hsing University, Taiwan, December 21, 2007.
- 29. "Vibration Analysis of Spinning Rotor Coupled with Flexible Housing," National Chung-Hsing University, Taiwan, December 20, 2007.
- 30. "PZT Thin-Film Microactuators for Combined Electric and Acoustic Stimulations," University of California, Los Angeles, March 6, 2009.
- 31. "Vibration Analysis of Spinning Rotors with Flexible Bearings and Housing Supports," Penn State University, State College, PA, March 23, 2010.
- 32. "Fundamentals of HDD Spindle Motor Dynamics," Data Storage Institute, Singapore, June 24, 2011.
- 33. "Vibration Analysis and Health Monitoring of Spinning Cyclic Symmetric Rotors with Flexible Bearing and Housing Supports," United Technology Research Center, East Hartford, CT, July 25, 2011.
- 34. "Development of an Acoustic Microactuator for Inner Ear Hearing Rehabilitation," University of Connecticut, December 4, 2015.