

Alper Erturk, Ph.D.

Research Scientist
Center for Intelligent Material Systems and Structures
Department of Mechanical Engineering
Virginia Polytechnic Institute and State University
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Education

- **2006-2009** **Ph.D. in Engineering Mechanics** (GPA: 4.00/4.00)
Advisor: Prof. Daniel J. Inman
Department of Engineering Science and Mechanics
Virginia Polytechnic Institute and State University (Virginia Tech)
Blacksburg, VA, USA
- **2004-2006** **M.S. in Mechanical Engineering** (GPA: 3.86/4.00)
Advisors: Prof. H. Nevzat Ozguven, Prof. Erhan Budak
Department of Mechanical Engineering
Middle East Technical University (METU)
Ankara, Turkey
- **2000-2004** **B.S. in Mechanical Engineering†** (GPA: 3.73/4.00)
Department of Mechanical Engineering
Middle East Technical University
Ankara, Turkey

Academic Experience

- **2007-2009** **Graduate Research Assistant**
Center for Intelligent Material Systems and Structures
Department of Mechanical Engineering
Virginia Polytechnic Institute and State University

Description and Responsibilities: *Developed distributed-parameter electromechanical models (analytical and approximate analytical solutions) to predict and optimize the electrical and mechanical response characteristics of piezoelectric energy harvesters with applications to unmanned air vehicles (UAVs). Validated the mathematical models developed against several experimental cases with frequency-domain and time-domain measurements. Worked on novel concepts in vibration energy harvesting (such as the concept of self-charging structures) and introduced novel vibration energy harvester configurations (such as the piezomagnetoelastic broadband power generator). Worked on several other problems related to modeling and applications of piezoelectric materials, ranging from shunt damping to structural actuation, with applications to morphing-wing aircrafts, machine tool structures and bridges.*

- **2009 (Fall)** **Instructor** (co-instructor with Prof. Daniel J. Inman)
Department of Mechanical Engineering
Virginia Polytechnic Institute and State University

† Graduated with High Honors and the 3rd rank out of 277 Mechanical Engineering students.

Description and Responsibilities: (ME 5514: Vibrations of Mechanical Systems) *Will teach the material covered in “Engineering Vibration, 3rd Edition, D.J. Inman, Prentice Hall” to graduate students, grade homework and exam papers and organize the experiment-based final exam as a co-instructor of this three-credit graduate-level vibrations course.*

- **2009 (Spring)** **Instructor** (for three lectures)
Department of Mechanical Engineering
Virginia Polytechnic Institute and State University

Description and Responsibilities: (ME 5984 Energy Harvesting) *As a co-instructor, taught the book chapter by A. Erturk and D.J. Inman in “Energy Harvesting Technologies, Eds: S. Priya and D.J. Inman, Springer” on electromechanical modeling of piezoelectric energy harvesters to graduate students from ME department. The content included a review of ordinary and partial differential equations, lumped-parameter and distributed-parameter vibrating systems, piezoelectricity, lumped-parameter and distributed-parameter piezoelectromechanical modeling. Prepared and graded a homework assignment and a midterm exam problem.*

- **2007 (Fall)** **Instructor** (co-instructor with Prof. Daniel J. Inman)
Department of Mechanical Engineering
Virginia Polytechnic Institute and State University

Description and Responsibilities: (ME 5514: Vibrations of Mechanical Systems) *Taught the material covered in “Engineering Vibration, 3rd Edition, D.J. Inman, Prentice Hall” to graduate students from ME, AOE and CEE departments, graded homework papers and organized the experiment-based final exam as a co-instructor of this three-credit graduate-level vibrations course.*

- **2006 (Fall)** **Graduate Teaching Assistant**
Department of Engineering Science and Mechanics
Virginia Polytechnic Institute and State University

Description and Responsibilities: (ESM 3064: Mechanical Behavior of Materials Laboratory) *As an instructor of this one-credit junior-level course offered to ESM, ME, CEE and MSE students, taught twelve fundamental experiments on mechanics of materials (e.g. testing of composites polymers, reinforced concretes), supervised students during the experiments, graded lab reports, did overall letter grading, etc. Overall instructor evaluation was 3.50/4.00.*

- **2004-2006** **Graduate Teaching Assistant**
Department of Mechanical Engineering
Middle East Technical University

Description and Responsibilities: *Prepared and graded homework and term projects, taught lab courses and graded lab reports, taught mathematical programming in software such as MATLAB, Mathcad, etc. (Courses: ME 200: Mechanical Engineering Orientation, ME 307: Machine Elements I, ME 301: Theory of Machines II, ME 410: Mechanical Engineering Systems Laboratory, ME 429: Mechanical Vibrations)*

Academic Interests

- Structural dynamics, mechanical vibrations, smart materials, electromechanical systems
- Interdisciplinary problems of sustainable energy and applied mechanics
- Experimental mechanics and modal analysis
- Modeling and applications of piezoelectric materials in structural dynamics (e.g. vibration energy harvesting, structural sensing, actuation and shunt damping)

- Self-charging structures using flexible piezoceramics and thin-film batteries
- Piezo-aero-elastic models for energy harvesting from flow excitation
- Investigation of combined piezoelectric energy harvesting, shunt damping and structural control in morphing wing aircrafts
- Investigation of the effect of piezoelectric shunt damping on the flutter and limit cycle characteristics of flexible aircraft wings
- Piezoelectric energy harvesting from civil engineering structures
- Nonlinear vibrations of electromechanical systems
- Utilization of chaotic vibrations and instabilities in piezoelectric energy harvesting
- Combined piezoelectric-electromagnetic power generation from ambient vibrations
- Multi-mode energy harvesting using wind, vibration and solar energy
- Suppression of chatter vibrations in machining processes via piezoelectric shunt damping
- Implementation of substructure techniques for identification of contact dynamics
- Modeling of spindle-tool dynamics in machining centers for chatter stability (frequency response prediction, effect analysis of bearing and contact dynamics, spindle design and selection of assembly parameters for chatter suppression)

List of Publications[‡]

Book chapters (since 2009):

Erturk, A. and Inman, D.J., 2009, Electromechanical Modeling of Cantilevered Piezoelectric Energy Harvesters for Persistent Base Motions, *Energy Harvesting Technologies*, Chapter 2, pp. 41-77, Springer, New York (Eds: S. Priya and D.J. Inman).

Journal articles (since 2006):

In preparation

Erturk, A., De Marqui, Jr., C., and Inman, D.J., 2009, An Electromechanical Model for Piezoelectric Energy Harvesting from Flow Excitation of Unswept Cantilevered Wings (in preparation).

Erturk, A., Anton, S.R., and Inman, D.J., 2009, Self-Charging Structures Using Piezoceramics and Thin-Film Batteries: Theory and Analysis, *Smart Materials and Structures* (invited – in preparation).

Anton, S.R., **Erturk, A.**, and Inman, D.J., 2009, Self-Charging Structures Using Piezoceramics and Thin-Film Batteries: Experimental Study, *Smart Materials and Structures* (invited – in preparation).

Erturk, A., Budak, E., and Inman, D.J., 2009, Piezoelectric Shunt Damping for Chatter Suppression in Machining Processes: Modeling and Application, *International Journal of Machine Tools and Manufacture* (in preparation).

In review

Lallart, M., **Erturk, A.**, Blettery, H., and Inman, D.J., 2009, Small-Scale Rainmill for Piezoelectric Energy Harvesting, *Smart Materials and Structures* (in review).

[‡] Total number of external citations in refereed journals and books (since 2007) > **40** (h-index: 4).

Kong, N., Ha, D.S., **Erturk, A.**, and Inman, D.J., 2009, Resistive Impedance Matching Circuit for Piezoelectric Energy Harvesting, *Journal of Intelligent Material Systems and Structures* (accepted).

Bilgen, O., **Erturk, A.**, and Inman, D.J., 2009, Analytical and Experimental Characterization of Macro-Fiber Composite Actuated Thin Clamped-Free Unimorph Benders, *ASME Journal of Vibration and Acoustics* (in review).

Published

Erturk, A., Hoffmann, J., and Inman, D.J., 2009, A Piezomagnetoelastic Structure for Broadband Vibration Energy Harvesting, *Applied Physics Letters*, **94**, 254102 (3pp).[§]

Erturk, A. and Inman, D.J., 2009, An Experimentally Validated Bimorph Cantilever Model for Piezoelectric Energy Harvesting from Base Excitations, *Smart Materials and Structures*, **18**, 025009 (18pp).^{**}

Erturk, A., Renno, J.M., and Inman, D.J., 2009, Modeling of Piezoelectric Energy Harvesting from an L-Shaped Beam-Mass Structure with an Application to UAVs, *Journal of Intelligent Material Systems and Structures*, **20**, pp. 529-544.

Erturk, A., Tarazaga, P.A., Farmer, J.R., and Inman, D.J., 2009, Effect of Strain Nodes and Electrode Configuration on Piezoelectric Energy Harvesting from Cantilevered Beams, *ASME Journal of Vibration and Acoustics*, **131**, 011010 (11pp).

De Marqui, Jr., C., **Erturk, A.**, and Inman, D.J., 2009, An Electromechanical Finite Element Model for Piezoelectric Energy Harvester Plates, *Journal of Sound and Vibration*, **327**, pp. 9-25.

Ozsahin, O., **Erturk, A.**, Ozguven H.N., and Budak, E., 2009, A Closed-Form Approach for Identification of Dynamical Contact Parameters in Spindle-Holder-Tool Assemblies, *International Journal of Machine Tools and Manufacture*, **49**, pp. 25-35.

Erturk, A., Bilgen, O., and Inman, D.J., 2008, Power Generation and Shunt Damping Performance of a Single Crystal Lead Magnesium Niobate – Lead Zirconate Titanate Unimorph: Analysis and Experiment, *Applied Physics Letters*, **93**, 224102 (3pp).

Erturk, A. and Inman, D.J., 2008, Issues in Mathematical Modeling of Piezoelectric Energy Harvesters, *Smart Materials and Structures*, **17**, 065016 (14pp).^{††}

Erturk, A. and Inman, D.J., 2008, Comment on ‘Modeling and Analysis of a Bimorph Piezoelectric Cantilever Beam for Voltage Generation’, *Smart Materials and Structures*, **17**, 058001 (3pp).

[§] Featured article (and the most downloaded article) of the Applied Physics Letters (Research Highlights - July 2009). Relevant news articles have appeared in the *Inside Science News Service* (American Institute of Physics) and in the *MRS Bulletin* (Materials Research Society).

^{**} This article was downloaded more than 500 times (and was among the top 3 % of the Institute of Physics downloaded articles).

^{††} This article was downloaded more than 500 times (and was among the top 3 % of the Institute of Physics downloaded articles).

Erturk, A. and Inman, D.J., 2008, A Distributed Parameter Electromechanical Model for Cantilevered Piezoelectric Energy Harvesters, *ASME Journal of Vibration and Acoustics*, **130**, 041002 (15pp).^{##}

Erturk, A. and Inman, D.J., 2008, On Mechanical Modeling of Cantilevered Piezoelectric Vibration Energy Harvesters, *Journal of Intelligent Material Systems and Structures*, **19**, pp. 1311-1325.

Erturk, A. and Inman, D.J., 2007, On the Fundamental Transverse Vibration Frequency of a Free-Free Thin Beam with Identical End Masses, *ASME Journal of Vibration and Acoustics*, **129**, pp. 656-662.

Erturk, A., Budak, E., and Ozguven H.N., 2007, Selection of Design and Operational Parameters in Spindle-Holder-Tool Assemblies for Maximum Chatter Stability by Using a New Analytical Model, *International Journal of Machine Tools and Manufacture*, **47**, pp. 1401-1409.^{§§}

Erturk, A., Ozguven, H.N., and Budak, E., 2007, Effect Analysis of Bearing and Interface Dynamics on Tool Point FRF for Chatter Stability in Machine Tools by using a New Analytical Model for Spindle-Tool Assemblies, *International Journal of Machine Tools and Manufacture*, **47**, pp. 23-32.

Erturk, A., Ozguven, H.N., and Budak, E., 2006, Analytical Modeling of Spindle-Tool Dynamics on Machine Tools using Timoshenko Beam Model and Receptance Coupling for the Prediction of Tool Point FRF, *International Journal of Machine Tools and Manufacture*, **46**, pp. 1901-1912.^{***}

Budak, E., **Erturk, A.**, and Ozguven, H.N., 2006, A Modeling Approach for Analysis and Improvement of Spindle-Holder-Tool Assembly Dynamics, *CIRP Annals – Manufacturing Technology*, **55**, pp. 369-372.^{†††}

Conference articles and workshop presentations (since 2006):

Erturk, A., Vieira, W.G.R, De Marqui, Jr., C., and Inman, D.J., 2010, Piezoelectric Energy Harvesting from Flow Excitation: Modeling and Experiment, *Proceedings of the 17th SPIE Annual International Symposium on Smart Structures and Materials & Nondestructive Evaluation and Health Monitoring*, San Diego, CA, 7-11 March 2010.

Anton, S.R., **Erturk, A.**, and Inman, D.J., 2010, Strength Analysis of Piezoceramic Materials for Structural Considerations in Energy Harvesting for UAVs, *Proceedings of the 17th SPIE Annual International Symposium on Smart Structures and Materials & Nondestructive Evaluation and Health Monitoring*, San Diego, CA, 7-11 March 2010.

Erturk, A., Hoffmann, J., and Inman, D.J., 2010, Limit Cycle Oscillations of a Nonlinear Piezo-Magneto-Elastic Structure for Broadband Vibration Energy Harvesting, *Proceedings of the 28th International Modal Analysis Conference*, Jacksonville, FL, 1-4 February 2010.

^{##} Ranked 1st among the monthly Top 10 most downloaded articles of the journal (June-August 2008).

^{§§} Selected for this special issue of the journal from the respective conference.

^{***} Ranked 5th among the quarterly Top 25 most downloaded articles of the journal (October-December 2006).

^{†††} Also presented in the 56th CIRP General Assembly, Kobe, Japan, 20-26 August 2006.

De Marqui, Jr., C., Vieira, W.G.R, **Erturk, A.**, and Inman, D.J., 2010, Frequency Domain Solution of a Piezo-Aero-Elastic Wing for Energy Harvesting, *Proceedings of the 28th International Modal Analysis Conference*, Jacksonville, FL, 1-4 February 2010.

Anton, S.R., **Erturk, A.**, Kong, N., Ha, D.S., and Inman, D.J., 2009, Self-Charging Structures Using Piezoceramics and Thin-Film Batteries, *Proceedings of the ASME Conference on Smart Materials, Adaptive Structures and Intelligent Systems*, Oxnard, CA, 20-24 September 2009.##

De Marqui, Jr., C., **Erturk, A.**, and Inman, D.J., 2009, Effect of Segmented Electrodes on Piezo-Elastic and Piezo-Aero-Elastic Responses of Generator Plates, *Proceedings of the ASME Conference on Smart Materials, Adaptive Structures and Intelligent Systems*, Oxnard, CA, 20-24 September 2009.

Erturk, A., Anton, S.R., Bilgen, O., and Inman, D.J., 2009, Effect of Material Constants and Mechanical Damping on Piezoelectric Power Generation, *Proceedings of the ASME 2009 IDETC 22nd Biennial Conference on Mechanical Vibration and Noise*, San Diego, CA, 30 August - 2 September 2009.

De Marqui, Jr., C., **Erturk, A.**, and Inman, D.J., 2009, Piezo-Aero-Elastically Coupled Modeling and Analysis of Electrical Power Generation and Shunt Damping for a Cantilever Plate, *Proceedings of the 17th International Conference on Composite Materials*, Edinburgh, UK, 27-31 July 2009.

Anton, S.R., **Erturk, A.**, and Inman, D.J., 2009, An Investigation on Multifunctional Piezoelectric Composite Spars for Energy Harvesting in Unmanned Aerial Vehicles, *Proceedings of the 17th International Conference on Composite Materials*, Edinburgh, UK, 27-31 July 2009.

Erturk, A., Anton, S.R., Tarazaga, P.A., and Inman, D.J., 2009, Analytical Modeling and Experimental Verification of a Broadband Piezoelectric Energy Harvester, *Proceedings of the Joint ASCE-ASME-SES Conference on Mechanics and Materials*, Blacksburg, VA, 24-27 June 2009.

De Marqui, Jr., C., **Erturk, A.**, and Inman, D.J., 2009, Finite Element Analysis of a UAV Wing Spar with Piezoceramics for Vibration Energy Harvesting, *Proceedings of the 50th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference*, Palm Springs, CA, 4-7 May 2009.

Erturk, A., Anton, S.R., Kong, N., and Inman, D.J., 2009, Self-powered Border Security Systems, *3rd National Security Innovation Competition* (presentations of the finalist universities), Colorado Springs, CO, 1 May 2009.

Erturk, A., Anton, S.R., and Inman, D.J., 2009, Piezoelectric Energy Harvesting from Multifunctional Wing Spars for UAVs – Part 1: Coupled Modeling and Preliminary Analysis, *Proceedings of the 16th SPIE Annual International Symposium on Smart Structures and Materials & Nondestructive Evaluation and Health Monitoring*, San Diego, CA, 8-12 March 2009.

Anton, S.R., **Erturk, A.**, and Inman, D.J., 2009, Piezoelectric Energy Harvesting from Multifunctional Wing Spars for UAVs – Part 2: Experiments and Storage Applications, *Proceedings of the 16th SPIE Annual International Symposium on Smart Structures and Materials & Nondestructive Evaluation and Health Monitoring*, San Diego, CA, 8-12 March 2009.

Received the *Best Student Paper* award in ASME SMASIS 2009.

Erturk, A. and Inman, D.J., 2009, Parameter Identification and Optimization for Cantilevered Piezoelectric Energy Harvesters Based on the Coupled Distributed Parameter Solution, *Proceedings of the 27th International Modal Analysis Conference*, Orlando, FL, 9-12 February 2009.

De Marqui, Jr., C., **Erturk, A.**, and Inman, D.J., 2009, Piezo-Aero-Elastic Analysis of a Unimorph Cantilever for Vibration Energy Harvesting, *4th Annual Energy Harvesting Workshop*, Blacksburg, VA, 28-29 January 2009.

Erturk, A. and Inman, D.J., 2009, Issues in Mathematical Modeling of Piezoelectric Energy Harvesters and Some Practical Considerations, *4th Annual Energy Harvesting Workshop*, Blacksburg, VA, 28-29 January 2009.

Inman, D.J., **Erturk, A.**, and Bilgen, O., 2008, Morphing, Monitoring and Harvesting Using Smart Materials, *Proceedings of the XII. International Conference on Mechanical Engineering*, Bratislava, Slovakia, 13-14 November 2008 (**keynote address**).

Erturk, A., Bilgen, O., and Inman, D.J., 2008, Performance Analysis of Single Crystal PMN-PZT Unimorphs for Piezoelectric Energy Harvesting, *Proceedings of the ASME Conference on Smart Materials, Adaptive Structures and Intelligent Systems*, Ellicott City, MD, 28-30 October 2008.

Erturk, A., Bilgen, O., Fontenille, M., and Inman, D.J., 2008, Piezoelectric Energy Harvesting from Macro-Fiber Composites with an Application to Morphing Wing Aircrafts, *Proceedings on the 19th International Conference of Adaptive Structures and Technologies*, Monte Verità, Ascona, Switzerland, 6-9 October 2008.

Bilgen, O., **Erturk, A.**, Inman, D.J., and Kochersberger K.B., 2008, Macro-Fiber Composite Actuated Thin Clamped-Free Benders and Thin Simply-Supported Morphing Airfoils, *Proceedings of the 19th International Conference on Adaptive Structures and Technologies*, Monte Verità, Ascona, Switzerland, 6-9 October 2008.

Erturk, A. and Inman, D.J., 2008, Piezoelectric Shunt Damping for Chatter Suppression in Machining Processes, *Proceedings of the ISMA2008 International Conference on Noise and Vibration Engineering*, Leuven, Belgium, 15-17 September 2008.

Erturk, A. and Inman, D.J., 2008, Electromechanical Modeling of Piezoelectric Energy Harvesters for Persistent Ambient Vibrations, *The Mechanics Conference to Celebrate the 100th Anniversary of the Department of Engineering Science and Mechanics*, Blacksburg, VA, 29-30 May 2008.

Erturk, A. and Inman, D.J., 2008, Analytical Modeling of Cantilevered Piezoelectric Energy Harvesters for Transverse and Longitudinal Base Motions, *Proceedings of the 49th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference*, Schaumburg, IL, 7-10 April 2008.

Erturk, A., Renno, J.M., and Inman, D.J., 2008, Energy Harvesting from a Piezoelectric Bender through Rigid Body Motion of a Two-Link Manipulator, *Proceedings of the 49th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conf.*, Schaumburg, IL, 7-10 April 2008.

Erturk, A., Renno, J.M., and Inman, D.J., 2008, Piezoelectric Energy Harvesting from an L-Shaped Beam-Mass Structure, *Proceedings of the 15th SPIE Annual International Symposium on Smart Structures and Materials & Nondestructive Evaluation and Health Monitoring*, San Diego,

CA, 9-13 March 2008.

Anton, S.R., **Erturk, A.**, and Inman, D.J., 2008, Energy Harvesting from Small Unmanned Air Vehicles, *Proceedings of the 17th International Symposium on Application of Ferroelectrics, 3rd Annual Energy Harvesting Workshop*, Santa Fe, NM, 24-27 February 2008.

Erturk, A., Anton, S.R., and Inman, D.J., 2007, Energy Harvesting from Rigid Body Motions, *Proceedings of the 18th International Conference on Adaptive Structures and Technologies*, Ottawa, Ontario, Canada, 3-5 October 2007.

Erturk, A. and Inman, D.J., 2007, Mechanical Considerations for Modeling of Vibration-Based Energy Harvesters, *Proceedings of the ASME 2007 IDETC 21st Biennial Conference on Mechanical Vibration and Noise*, Las Vegas, NV, 4-7 September 2007.

Inman, D.J. and **Erturk, A.**, 2007, Energy Harvesting Using Smart Materials, *Proceedings of the III. ECCOMAS Thematic Conference on Smart Structures and Materials*, Gdansk, Poland, 9-11 July 2007 (**keynote address**).

Erturk, A., Budak, E., and Ozguven, H.N., 2006, Selection of Design and Operational Parameters in Spindle-Holder-Tool Assemblies for Maximum Chatter Stability by Using a New Analytical Model, *Proceedings of the 2nd CIRP Conference on High Performance Cutting*, Vancouver, BC Canada, 12-13 June 2006.

M.S. Thesis:

Erturk, A., 2006, Dynamic Modeling of Spindle-Tool Assemblies in Machining Centers, M.S. Thesis, (xxii+202 pages), Department of Mechanical Engineering, Middle East Technical University, Ankara, Turkey, May 2006.^{§§§}

Seminars, Invited Lectures and Short Courses

Erturk, A., *Applications of Smart Materials in Aerospace Engineering*, Invited Lecture in the 6th Aeronautical Engineering Week, Department of Aeronautical Engineering, Engineering School of Sao Carlos, University of Sao Paulo, SP, Brazil, August 21, 2009.

Erturk, A., *Piezoelectric Energy Harvesting: Modeling and Applications*, Invited Lecture, Department of Aeronautical Engineering, Engineering School of Sao Carlos, University of Sao Paulo, SP, Brazil, August 20, 2009.

Erturk, A., *Smart Materials and Structures: Fundamentals and Applications*, Short Course in the 6th Aeronautical Engineering Week, Department of Aeronautical Engineering, Engineering School of Sao Carlos, University of Sao Paulo, SP, Brazil, August 18, 2009.

Erturk, A., *Piezoelectric Energy Harvesting: Analytical Modeling and Experimental Validations*, Liviu Librescu Memorial Scholarship Seminar, Department of Engineering Science and Mechanics, Virginia Polytechnic Institute and State University, Blacksburg, VA, November 12, 2008.

^{§§§} Received the *Thesis of the Year Award* of the METU Parlar Foundation in December 2006.

Relevant Projects

- *Ph.D. research:* U.S. Air Force Office of Scientific Research (AFOSR) MURI, Grant No. F 9550-06-1-0326: “*Energy Harvesting and Storage Systems for Future Air Force Vehicles*” and U.S. Department of Commerce, National Institute of Standards and Technology, Technology Innovation Program, Cooperative Agreement Number 70NANB9H9007.
- *M.S. research:* The Scientific and Technological Research Council of Turkey, Project No. 104M430: “*Improvement of Process Efficiency in High Speed Machining by Modeling of Machine Tool and Workpiece Dynamics Using Advanced Structural Dynamics Techniques.*”

Proposal Experience

- *Self-Powered Seismic Protection Systems* - Hazard Mitigation and Structural Engineering Program, National Science Foundation, \$ 535,241, with Prof. Daniel J. Inman (in preparation).
- Helped Prof. Daniel J. Inman with various proposals (NIST, AFOSR, NSF, various companies), with meeting with sponsors, for reviews and to seek new funding and helped host visitors who are possible funding sources. Two recent proposal examples are
 - *Self-Charging Systems: A Multifunctional Approach* - Air Force Office of Scientific Research, \$ 812,394, submitted 10 June 2009 (in review).
 - *Simultaneous Vibration Suppression and Energy Harvesting* - Air Force Office of Scientific Research, \$ 602,911, submitted 1 May 2009 (funded).

Patent Applications

- *Piezo-Magneto-Elastic Power Generator for Broadband Vibration Energy Harvesting* (Erturk, A. and Inman, D.J.), U.S. Patent Application No. 61/269,662, VTIP No. 09-172 (date filed: June 26, 2009)
- *Self-Charging Structures with Flexible Piezoceramics and Thin-Film Batteries* (Anton, S.R., Erturk, A. and Inman, D.J.), U.S. Patent Application No. 61/158,568, VTIP No. 09-071 (date filed: March 9, 2009)
- *Combined Piezoelectric and Electromagnetic Energy Harvesting for Moving Platforms* (Erturk, A. and Inman, D.J.), U.S. Patent Application No. 61/203,965, VTIP No. 09-065 (date filed: December 31, 2008)
- *L-Shaped Beam-Mass Structure for Piezoelectric Energy Harvesting* (Erturk, A., Renno, J.M., and Inman, D.J.), U.S. Patent Application No. 61/098,789, VTIP No. 08-074 (date filed: September 21, 2008)

Current Active Collaborators

- Dr. C. De Marqui Jr., Department of Aeronautical Engineering, University of Sao Paulo, Sao Carlos, SP, Brazil
- Dr. E. Budak, Director of the Manufacturing Research Lab, Faculty of Engineering and Natural Sciences, Sabanci University, Istanbul, Turkey

- Mr. S.R. Anton, Graduate research assistant, Center for Intelligent Material Systems and Structures, Department of Mechanical Engineering, Virginia Tech
- Ms. N. Kong, Graduate research assistant, VLSI for Telecommunications Group, Department of Electrical and Computer Engineering, Virginia Tech

Students Advised

- Mr. J. Hoffmann, *Institut Catholique d'Arts et Métiers*, Lille, France
February – June 2009 (*completed experiments with the piezo-magneto-elastic structure*)
- Mr. M. Fontenille, *Université de Technologie de Compiègne*, Compiègne, France
February – July 2008 (*completed experiments with micro-fiber composite piezoceramics, the L-shaped energy harvester and piezoelectric-electromagnetic energy harvester*)
- Mr. G. Kleinhans, *Institut Catholique d'Arts et Métiers*, Lille, France
August – December 2007 (*completed experiments for energy harvesting from acoustic excitation of PVDF membranes*)

Student Member of

- American Society of Mechanical Engineers (ASME)
- American Institute of Aeronautics and Astronautics (AIAA)
- The International Society for Optical Engineering (SPIE)
- Society for Experimental Mechanics (SEM)

Service to the Profession

Reviewer

- Journal of Applied Physics
- Journal of Micromechanics and Microengineering
- Journal of Mechanics of Materials and Structures
- Measurement Science and Technology
- Smart Materials and Structures
- Journal of Intelligent Material Systems and Structures
- Physica D: Nonlinear Phenomena
- Journal of Sound and Vibration
- ASME Journal of Vibration and Acoustics
- IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control
- Shock and Vibration
- Meccanica
- AIAA/ASME/AHS Adaptive Structures Conference
- ASME IDETC/CIE

Session chair

- SPIE 2009: *PZT Energy Harvesting Session*
- ASME-ASCE-SES 2009 Joint Conference on Mechanics and Materials: *Dynamics Session*
- ASME SMASIS 2009: *Bio-Inspired Hydro-Structures*
- IMAC 2010: *Electromagnetic, Magnetostrictive and Piezoelectric Energy Harvesting Sessions*

Session organizer

- IMAC 2010: *Electromagnetic, Magnetostrictive and Piezoelectric Energy Harvesting Sessions*

Graduate Courses Taken in the Field of Interest

- Advanced Vibrations (*Nonlinear Oscillations - ESM 6304, Virginia Tech*)
- Energy and Variational Methods in Applied Mechanics (*ESM 5744, Virginia Tech*)
- Elastic Stability (*ESM 5454, Virginia Tech*)
- Acoustic-Structure Interaction (*ME 6704, Virginia Tech*)
- Energy Harvesting Using Smart Materials (*ME 6984, Virginia Tech*)
- Vibrations of Mechanical Systems (*ME 5514, Virginia Tech*)
- Structural Dynamics and Earthquake Engineering (*ESM 5464, Virginia Tech*)
- Mechanics of Laminated Composite Structures (*ESM 5074, Virginia Tech*)
- Theory of Elasticity (*ESM 5124, Virginia Tech*)
- Introduction to Continuum Mechanics (*ESM 5014, Virginia Tech*)
- Wave Analysis and Wave Propagation in Structures (*AE 564, METU*)
- Analysis and Measurement Techniques for Random Vibration and Noise (*ME 520, METU*)
- Vibrations of Continuous Systems with Computational Methods (*ME 526, METU*)
- Flexible Multibody Dynamics (*ME 528, METU*)
- Advanced Machinery Vibrations (*ME 532, METU*)

Industrial Experience

- **July 2003** **Project Intern**
Product Development Department
Arcelik Refrigerator Plant, Inc., Eskisehir, Turkey

Description: Completed an industrial design project (which was later patented by the company): "A sliding wine bottle rack for cooling of 1 to 3 bottles". Designed the product and administered the manufacturing process of the prototype. The simple design is today being used in various national (Arcelik) and international (BEKO) refrigerator models of the company.

- **July 2002** **Production Intern**
Engineering Management
TEI (TUSAS Engine Industries, Inc.), Eskisehir, Turkey

Description: Investigated the manufacturing processes of various jet engine components at this joint company of the Turkish Aerospace Industries, Turkish Air Force and General Electric.

Awards, Scholarships, Honors, Notable News

- *Featured Article* (and the most downloaded article) in Applied Physics Letters (American Institute of Physics): "A Piezomagnetoelastic Structure for Broadband Vibration Energy Harvesting" (July 2009) – Relevant news articles: (1) "Piezomagnetoelastic Device Harvests Vibrational Energy" by A. Hatt, *Research/Researchers in the MRS Bulletin* of the Materials Research Society (September 2009) (2) "Good Vibrations Generate Electricity" by P.F. Schewe, *Inside Science News Service* of the American Institute of Physics (August 2009)
- Co-authored the *Best Student Paper* of the ASME 2009 Conference on Smart Materials, Adaptive Structures and Intelligent Systems (September 2009)
- *ASME & AIAA Adaptive Structures & Material Systems Newsletter, Student Spotlight* (Spring 2009)
- *Liviu Librescu Memorial Scholarship* of the Department of Engineering Science and Mechanics at Virginia Tech (the first recipient - Fall 2008) – rewarded based on the criteria

of “*having the potential for scholarly achievement in teaching and research, and a demonstrated dedication to the welfare and well-being of others*”

- Biography listed in *Marquis Who’s Who in America*
- *Publication Encouragement Prize* of the Scientific and Technological Research Council of Turkey for the journal papers in SCI from the M.S. thesis (4 times in 2007)
- *Thesis of the Year Award* of the METU Parlar Foundation for the M.S. Thesis (December 2006)
- *Project Encouragement Prize* of the Scientific and Technological Research Council of Turkey for Project No. 104M430 (October 2006)
- *National M.S. Scholarship* of the Scientific and Technological Research Council of Turkey (March 2005 - May 2006)
- Ranked 1st in the oral *Graduate Teaching Assistant Examination* of the Department of Mechanical Engineering at METU (July 2004)
- *High Honor certificates* of the President (during the undergraduate study) and graduation with High Honors and the 3rd rank out of 277 ME students at METU
- *Plaques and certificates* for the rankings (top 3) from the Department of Mechanical Engineering at METU (during the undergraduate study)
- *Prime Ministry Scholarship* of Turkey for the undergraduate study (2000-2004)