

STEVEN R. ANTON, PH.D.

santon@tntech.edu

Assistant Professor
Department of Mechanical Engineering
Tennessee Technological University
Box 5014, Cookeville, TN 38505
Phone 931.372.3287

EDUCATION

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| Ph.D., Mechanical Engineering
Virginia Polytechnic Institute and State University, Blacksburg, VA
<i>Dissertation Title:</i> Multifunctional piezoelectric energy harvesting concepts
Advisor: Dr. Daniel J. Inman | April, 2011 |
| M.S., Mechanical Engineering
Virginia Polytechnic Institute and State University, Blacksburg, VA
<i>Thesis Title:</i> Baseline-free and self-powered structural health monitoring
Advisor: Dr. Daniel J. Inman | June, 2008 |
| B.S., Mechanical Engineering
Michigan Technological University, Houghton, MI
Institutional Honors: Summa Cum Laude | April, 2006 |

RESEARCH INTERESTS

The central theme of my research involves characterizing the dynamic response of smart material systems for engineering applications. By combining expertise in structural dynamics, behavior of active materials, experimental mechanics and signal processing, my research aims to discover new phenomenon associated with the dynamics of smart materials. Specific research topics of interest include energy harvesting, structural health monitoring, biomedical sensing, and actuation. In the area of structural health monitoring, my research interests lie in the development of a real-time microsecond state monitoring framework to allow continuous monitoring of structures operating in highly dynamic environments. In the area of biomedical sensing, my research interests focus on the integration of piezoelectric sensors in total knee replacements in order to provide in vivo load distribution data as well as embedded health monitoring of the joint for the life of the implant. Such in vivo data will be invaluable to the medical research community for improving surgical procedures, customizing physical therapy routines, and advancing implant designs. In the area of energy harvesting, my research interests consists of embedded energy harvesting and sensing in implantable biomedical devices; the investigation of novel energy harvesting transducer materials; and multifunctional energy harvesting in which a harvesting system serves multiple functionalities, such as combined harvesting, storage, and load-bearing ability. Finally, I am also passionate about STEM education and the development of robotics programs as a means of encouraging young students to pursue careers in science and technology.

RESEARCH EXPERIENCE

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|---|-----------------------|
| Assistant Professor, Department of Mechanical Engineering, Tennessee Technological University, Cookeville, TN | August 2013 – Present |
| <ul style="list-style-type: none">• Performing research on advancing smart material technologies• Research interests include identifying novel applications of smart material technologies, energy harvesting and sensing for in vivo biomedical applications, real-time microsecond structural health monitoring and prognostics, energy harvesting to create self-powered wireless sensors | |

- Additional research interests include incorporating smart materials into advanced manufacturing environments, vibrations, and modal analysis

Postdoctoral Research Associate, Los Alamos National Laboratory, Los Alamos, NM July 2011 – July 2013

- Conducted research on multi-source energy harvesting combining vibration and solar harvesting to power low-power embedded electronics on wind turbines
- Characterized novel piezoelectret polymer foam material for energy harvesting applications
- Performed research to develop vibratory and acoustic sensing systems for determination of steam quality in steam pipelines
- Mentored summer students investigating the mechanical strength of bone cement with and without screw augmentation in knee replacements (2012), and the quantification of prediction bounds caused by model form uncertainty (2013)

Graduate Research Assistant, Virginia Tech, Blacksburg, VA August 2006 – July 2011

- Performed experimental research on multifunctional piezoelectric energy harvesting in which piezoceramic layers were combined with thin-film battery layers to create *self-charging structures* capable of simultaneous energy harvesting and energy storage
- Developed an electromechanical model of *self-charging structures*, experimentally evaluated feasibility of simultaneous harvesting and storage, incorporated the structures into unmanned aerial vehicles (UAVs)
- Developed and experimentally validated a baseline-free wave propagation-based structural health monitoring (SHM) technique for damage detection in thin plates

Laboratory Manager, Center for Intelligent Material Systems and Structures (CIMSS), Blacksburg, VA January 2009 – May 2011

- Managed 6,000 square feet of lab and office space shared by five professors and over 30 graduate students
- Responsibilities included preparation and management of lab rules/contracts and safety certifications, maintenance, repair, and inventory of all lab equipment, and conducting of equipment and safety training

TEACHING EXPERIENCE

Courses Taught

Spring 2017: *Dynamics* (ME 2330), 1 sections, 44 total students
 Fall 2016: *Dynamic Modeling and Controls* (ME 3050), 2 sections, 55 total students
 Fall 2016: *Dynamic Modeling and Controls Laboratory* (ME 3060), 4 sections, 71 total students
 Spring 2016: *Dynamic Modeling and Controls* (ME 3050), 2 sections, 53 total students
 Spring 2016: *Dynamic Modeling and Controls Laboratory* (ME 3060), 4 sections, 54 total students
 Fall 2015: *Special Topics – Smart Materials* (ME 6990), 1 sections, 14 total students
 Fall 2015: *Dynamic Modeling and Controls* (ME 3050), 1 sections, 34 total students
 Fall 2015: *Dynamic Modeling and Controls Laboratory* (ME 3060), 4 sections, 59 total students
 Fall 2015: *Special Problems* (ME 4990), 1 student, undergraduate research course
 Spring 2015: *Dynamic Modeling and Controls* (ME 3050), 2 sections, 59 total students
 Spring 2015: *Dynamic Modeling and Controls Laboratory* (ME 3060), 4 sections, 52 total students
 Spring 2015: *Special Problems* (ME 4990), 2 students, undergraduate research course
 Fall 2014: *Dynamic Modeling and Controls* (ME 3050), 2 sections, 64 total students
 Fall 2014: *Dynamic Modeling and Controls Laboratory* (ME 3060), 4 sections, 56 total students
 Spring 2014: *Dynamic Modeling and Controls* (ME 3050), 34 students
 Spring 2014: *Special Problems* (ME 4990), 1 student, undergraduate research course
 Fall 2013: *Dynamic Modeling and Controls* (ME 3050), 32 students
 AY 2007/08: *Senior Capstone Design* (ME 4015/4016), 11 students, co-taught with advisor

Students Advised**Current Graduate Students under Supervision**

1. Safaei, M., 8/15 – present (Ph.D.)
Project: "Self-Powered In-Vivo Force and Implant Wear Sensing in Knee Arthroplasty"
2. Mohammadzadeh, M., 6/17 – present (Ph.D.)
Project: "Real-Time State Detection in Highly Dynamic Environments"
3. Kettle, R., 8/14 – present (M.S.)
Project: "Real-Time State Detection in Highly Dynamic Environments"
4. Tefft, E., 8/15 – present (M.S.)
Project: "Multilayer Piezoelectret Foam Stack Energy Harvesting: Modeling and Experimentation"
5. Scheyer, A., 8/15 – present (M.S.)
Project: "Smart Parts: Embedded Sensing in Additive Manufacturing"
6. Ehite, E., 8/16 – present (M.S.)
Project: "Real-Time State Detection in Highly Dynamic Environments"
7. Ponder, R., 8/17 – present (M.S.)
Project: "Self-Powered In-Vivo Force and Implant Wear Sensing in Knee Arthroplasty"

M.S. Students Supervised

1. Wilson, B., 8/13 – 5/15
Project: "Modeling and Experimentation for Evaluation of Piezoelectric Sensors for In-Vivo Monitoring"
2. Ray, C., 8/13 – 5/15
Project: "Piezoelectret Foam in a Multilayer Stack Configuration for Vibration Energy Harvesting"

Undergraduate Students

1. Dupre, S., 8/17-12/17
Undergraduate Researcher, Tennessee Tech
Project: *Design, Analysis and Fabrication of an Updated Piezoelectric Force Plate*
2. Ponder, R., 1/17-4/17
Undergraduate Researcher, Tennessee Tech
Project: *Modeling and Prototyping of Artificial Knee Joint for Embedded Piezoelectric Transducers*
3. Baker, K., Foote, D., Hargis, B., Lark, A., McConnell, M., and Ponder, R., 1/17-4/17
Senior Capstone Design Student Group, Tennessee Tech
Project: *Condition Monitoring for Real-Time Assessment of Critical Infrastructure*
4. Cantu, A., Freeman, S., Garcia, C., Rose, Z., Shimbo, S., and Villalpando, M., 8/16-12/16
Senior Capstone Design Student Group, Tennessee Tech
Project: *Condition Monitoring for Real-Time Assessment of Critical Infrastructure*
5. Hoummadi, E., 8/16-12/16
Undergraduate Researcher, Tennessee Tech
Project: *Design, Analysis, and Fabrication of a Piezoelectric Force Plate*

6. Poissenot-Arrigoni, B., 8/16-12/16
Undergraduate Researcher, Tennessee Tech
Project: *Determination of Orthotropic Mechanical Properties of 3D Printed Parts for Structural Health Monitoring*
7. Adcock, C., Duke, W., Powelson, M., Schenk, W., and Staggs, H., 1/16-4/16
Senior Capstone Design Student Group, Tennessee Tech
Project: *Experimental Test-Bed for Real-Time State Monitoring*
8. Newton, R., 8/15-12/15
Undergraduate Researcher, Tennessee Tech
Project: *Parametric Study of Piezoelectret Foam*
9. Contreras, C. and Parkison, A., 1/15-5/15
Undergraduate Researchers, Tennessee Tech
Project: *Feasibility Analysis of Piezoelectric Materials in Knee Replacements*
10. Tefft, E., 6/14-8/14
Undergraduate Researcher, Tennessee Tech
Project: *Development of Automated Accelerometer Calibration System*
11. Mabe, N., 1/14-5/14
Undergraduate Researcher, Tennessee Tech
Project: *Gait Analysis for Injury Detection using Cell Phone Accelerometer*
12. Gonzales, L., and Hall, T., 6/13-7/13
Los Alamos Dynamics Summer School, Los Alamos National Laboratory
Project: *Quantification of Prediction Bounds caused by Model Form Uncertainty*
13. Keyser, R., Migliori, R., and Morgan, T., 6/12-8/12
Los Alamos Dynamics Summer School, Los Alamos National Laboratory
Project: *Mechanical Strength of Bone Cement with and without Adjuvant Screw Fixation*
14. Gambier, P., 2/10-6/10
Visiting Undergraduate Scholar, Virginia Tech
Project: *Fabrication and Experiments of a Multifunctional Energy Harvester*
15. Schlichiting, A., 6/07-8/07
NSF Research Experiences for Undergraduates (REU) Student, Virginia Tech
Project: *Motorcycle Waste Heat Energy Harvesting*

ADDITIONAL PROFESSIONAL EXPERIENCE

- Summer Student, Los Alamos National Laboratory**, Los Alamos, NM June 2006 – August 2006
- Participant in the 2006 Los Alamos Dynamics Summer School
- Engineering Intern, Continental Teves, Inc.**, Auburn Hills, MI Summer 2005, 2006
- Summer inter hired to develop portable data acquisition system for field measurements of noise, vibration and harshness in automobiles

PUBLICATIONS

Book Chapters

1. **Anton, S. R.** and Karami, M. A., 2017, Piezoelectric Energy Systems, chapter in *Encyclopedia of Sustainable Technologies*, Ed. Martin Abraham, Elsevier, United Kingdom.
2. **Anton, S. R.**, 2016, Chapter 5: Piezoelectric Conversion, chapter in *Materials for Sustainable Energy Applications. Conversion, Storage, Transmission and Consumption*, Eds. Xavier Moya & David Munoz-Rojas, Pan Stanford Publishing, Singapore.

Journal Papers

1. Safaei, M., Meneghini, R. M., and **Anton, S. R.**, 2017, Parametric Analysis of Electromechanical and Fatigue Performance of Total Knee Replacement Bearing with Embedded Piezoelectric Transducers, *Smart Materials and Structures*, Vol. 26, No. 9, 094002 (15 pp.).
2. Ray, C. A. and **Anton, S. R.**, 2016, Multilayer Piezoelectret Foam Stack for Vibration Energy Harvesting, *Journal of Intelligent Material Systems and Structures*, Vol. 28, No. 3, pp. 408-420.
3. Van Buren, K. L., Hall, T. M., Gonzales, L. M., Hemez, F. M., **Anton, S. R.**, 2015, A Case Study to Quantify Prediction Bounds Caused by Model-Form Uncertainty of a Portal Frame, *Mechanical Systems and Signal Processing*, Vols. 50-51, pp 11-26.
4. **Anton, S. R.**, Erturk, A., and Farinholt, K. M., 2014, Piezoelectret Foam-Based Vibration Energy Harvesting, *Journal of Intelligent Material Systems and Structures*, Vol. 25, No. 14, pp. 1681-1692.*
5. **Anton, S. R.**, Erturk, A., and Inman, D. J., 2012, Bending Strength of Piezoelectric Ceramics and Single Crystals for Multifunctional Load-Bearing Applications, *IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control*, Vol. 59, No. 6, pp. 1085-1092.
6. **Anton, S. R.**, Erturk, A., and Inman, D. J., 2012, Multifunctional Unmanned Aerial Vehicle Wing Spar for Low-Power Generation and Storage, *AIAA Journal of Aircraft*, Vol. 49, No. 1, pp. 292-301.
7. Gambier, P., **Anton, S. R.**, Kong, N., Erturk, A., and Inman, D. J., 2012, Piezoelectric, Solar and Thermal Energy Harvesting for Hybrid Low-Power Generator Systems with Thin-Film Batteries, *Measurement Science and Technology*, Vol. 23, No. 1, p 015101 (11 pp.).†
8. **Anton, S. R.**, Erturk, A., and Inman, D. J., 2010, Multifunctional Self-Charging Structures using Piezoceramics and Thin-Film Batteries, *Smart Materials and Structures*, Vol. 19, No. 11, pp. 115021 (15 pp.).‡
9. Park, S., **Anton, S. R.**, Kim, J.-K., Inman, D. J., and Ha, D. S., 2010, Instantaneous Baseline Structural Damage Detection using a Miniaturized Piezoelectric Guided Waves System, *KSCE Journal of Civil Engineering*, Vol. 14, No. 6, pp. 889-895.
10. Lallart, M., **Anton, S. R.**, and Inman, D. J., 2010, Frequency Self-Tuning Scheme for Broadband Vibration Energy Harvesting, *Journal of Intelligent Material Systems and Structures*, Vol. 21, No. 9, pp. 897-906.
11. **Anton, S. R.**, Park, G., and Inman, D. J., 2009, Reference-Free Damage Detection using Instantaneous Baseline Measurements, *AIAA Journal*, Vol. 47, No. 8, pp. 1952-1964.
12. **Anton, S. R.** and Sodano, H. A., 2007, A Review of Power Harvesting using Piezoelectric Materials (2003-2006), *Smart Materials and Structures*, Vol. 16, No. 3, R1-R21.§

* Featured article of JIMSS listed in the Editor's Choice – SMASIS 2014 collection.

† Featured article of Measurement Science and Technology listed in the Research Highlights of 2012.

‡ Featured article of Smart Materials and Structures listed in the Research Highlights of 2010. Also listed amongst the top 20 most cited articles published in 2010 in Smart Materials and Structures.

Conference Proceedings and Papers

1. Ponder, R. I., Safaei, M., and **Anton, S. R.**, Development of Surrogate Biomedical Knee Implants for Validation of Embedded Smart Sensors, *Proc. ASME SMASIS*, 2017, SMASIS2017-3879 (7 pp.).
2. Safaei, M. and **Anton, S. R.**, Experimental Evaluation of Sensing and Energy Harvesting Behavior of Implanted Piezoelectric Transducers in Total Knee Replacement, *Proc. ASME SMASIS*, 2017, SMASIS2017-3881 (8 pp.).**
3. Kettle, R. A., Ehite, E. H., and **Anton, S. R.**, Development of an Electromechanical Impedance Based Condition Monitoring System with Multi-Tonal Excitation, *Proc. Vibration Institute Annual Conference*, 2017 (18 pp.).
4. Hoummadi, E., Safaei, M., and **Anton, S. R.**, Design, Analysis, and Fabrication of a Piezoelectric Force Plate, *Proc. SPIE*, 2017, Vol. 10170, 101700W (11 pp.).
5. Poissenot-Arrigoni, B., Scheyer, A., and **Anton, S. R.**, Determination of Orthotropic Mechanical Properties of 3D Printed Parts for Structural Health Monitoring, *Proc. SPIE*, 2017, Vol. 10168, 101681D (9 pp.).
6. Safaei, M. and **Anton, S. R.**, Analytical and Finite Element Performance Evaluation of Embedded Piezoelectric Sensors in Polyethylene, *Proc. SPIE*, 2017, Vol. 10172, 101720I (12 pp.).
7. Scheyer, A. G. and **Anton, S. R.**, Impedance-Based Structural Health Monitoring of Additive Manufactured Structures with Embedded Piezoelectric Wafers, *Proc. SPIE*, 2017, Vol. 10168, 1016827 (10 pp.).
8. Tefft, E. C. and **Anton, S. R.**, A Multiple Degree of Freedom Model of Piezoelectret Foam in an Updated Multilayer Stack Configuration, *Proc. SPIE*, 2017, Vol. 10164, 1016404 (13 pp.).
9. Kettle, R. A., Dodson, J. C., and **Anton, S. R.**, High Frequency Impedance Measurements for Microsecond State Detection, *Proc. SEM IMAC*, 2017 (9 pp.).
10. Safaei, M. and **Anton, S. R.**, Sensing and Energy Harvesting Performance, and Fatigue Life of Embedded Piezoelectric Transducer in Total Knee Arthroplasty, *Proc. ASME SMASIS*, 2016, SMASIS2016-9216 (11 pp.).
11. Kettle, R. A. and **Anton, S. R.**, Rapid Evaluation of Mechanical Boundary Conditions using Impedance Based Structural Health Monitoring, *Proc. SPIE*, 2016, Vol. 9805, 98051S (13 pp.).
12. Safaei, M. and **Anton, S. R.**, The Effects of Dimensional Parameters on Sensing and Energy Harvesting of an Embedded PZT in a Total Knee Replacement, *Proc. SPIE*, 2016, Vol. 9799, 97992P (13 pp.).
13. Tefft, E. C., and **Anton, S. R.**, A Multiple Degree of Freedom Modeling Approach of Piezoelectret Foam in a Multilayer Stack Configuration, *Proc. SPIE*, 2016, Vol. 9799, 97991P (12 pp.).
14. Kettle, R. A., Dick, A. J., Dodson, J. C., Foley, J. R., and **Anton, S. R.**, Real-Time State Detection in Highly Dynamic Systems, *Proc. SEM IMAC*, 2016 (9 pp.).
15. Contreras, C. E., Parkison, A. E., Wilson, B. E., Meneghini, R. M., and **Anton, S. R.**, Geometric Effects on Embedded Piezoelectric Energy Harvester in Knee Replacement Bearing, *Proc. ASME SMASIS*, 2015, SMASIS2015-9063 (11 pp.).
16. Wilson, B. E., Meneghini, R. M., and **Anton, S. R.**, Embedded Piezoelectrics for Sensing and Energy Harvesting in Total Knee Replacement Units, *Proc. SPIE*, 2015, Vol. 9431, 943111E (10 pp.).
17. Ray, C. A. and **Anton, S. R.**, Evaluation of Piezoelectret Foam in a Multilayer Stack Configuration for Low-Level Vibration Energy Harvesting Applications, *Proc. SPIE*, 2015, Vol. 9431, 943111 (11 pp.).

[§] Listed in the “10 best and most highly cited review articles published in the journal’s history.” Most downloaded paper in Smart Materials and Structures in 2007. Currently has over 1,900 citations and over 25,000 downloads.

** Winner of the *Best Student Hardware Competition* award at ASME SMASIS 2017.

18. Wilson, B. E., **Anton, S. R.**, and Meneghini, R. M., Development of Biomechanical Knee Force Model for Evaluation of Piezoelectric Sensors for In-Vivo Monitoring, *Proc. ASME SMASIS*, 2014, SMASIS2014-7692 (5 pp.).
19. **Anton, S. R.**, Taylor, S. G., Raby, E. Y., and Farinholt, K. M., Powering Embedded Electronics for Wind Turbine Monitoring using Multi-Source Energy Harvesting Techniques, *Proc. SPIE*, 2013, Vol. 8690, 869007 (9 pp.).
20. Choi, M., Farinholt, K. M., **Anton, S. R.**, Lee, J.-R., Park, G., Multi-Source Energy Harvesting for Wireless SHM Systems, *Proc. SPIE*, 2013, Vol. 8690, 869008 (10 pp.).
21. Keyser, R., Migliori, R., Morgan, T., **Anton, S. R.**, Farinholt, K. M., and Meneghini, R. M., Mechanical Strength of Bone Cement With and Without Adjuvant Screw Fixation in Knee Replacement, *Proc. IMAC*, 2013, (15 pp.).
22. **Anton, S. R.** and Farinholt, K. M., Piezoelectret Foam-Based Vibration Energy Harvester for Low-Power Energy Generation, *Proc. ASME SMASIS*, 2012, SMASIS2012-8224 (9 pp.).
23. **Anton, S. R.**, Taylor, S. G., and Farinholt, K. M., Multi-Source Energy Harvesting for Wind Turbine Structural Health Monitoring Node, *Proc. ASHMCS*, 2012 (4 pp.).
24. **Anton, S. R.** and Farinholt, K. M., An Evaluation on Low-Level Energy Harvesting using Piezoelectret Foam, *Proc. SPIE*, 2012, Vol. 8341, 83410G-10 (10 pp.).
25. **Anton, S. R.** and Inman, D. J., Electromechanical Modeling of a Multifunctional Energy Harvesting Wing Spar, *Proc. AIAA/ASME/AHS ASC*, 2011 (18 pp.).
26. **Anton, S. R.** and Inman, D. J., Performance Modeling of Unmanned Aerial Vehicles with On Board Energy Harvesting, *Proc. SPIE*, 2011, Vol. 7977, 79771H-15 (14 pp.).
27. Gambier, P., **Anton, S. R.**, Kong, N., Erturk, A., and Inman, D. J., Combined Piezoelectric, Solar and Thermal Energy Harvesting for Multifunctional Structures with Thin-film Batteries, *Proc. ICASST*, 2010 (12 pp.).
28. **Anton, S. R.**, Erturk, A., and Inman, D. J., Strength Analysis of Piezoceramic Materials for Structural Considerations in Energy Harvesting for UAVs, *Proc. SPIE*, 2010, Vol. 7643, 76430E-11 (11 pp.).
29. Qing, X. P., **Anton, S. R.**, Zhang, D., Kumar, A., Inman, D. J., and Ooi, T. K., Autonomous Self-Powered Structural Health Monitoring System, *Proc. SPIE*, 2010, Vol. 7650, 765011 (12 pp.).
30. **Anton, S. R.**, Erturk, A., Kong, N., Ha, D. S., and Inman, D. J., Self-Charging Structures Using Piezoceramics and Thin-Film Batteries, *Proc. ASME SMASIS*, 2009, SMASIS2009-1368 (12 pp.).^{††}
31. Park, S., **Anton, S. R.**, Inman, D. J., Kim, J.-K., Ha, D. S., Instantaneous Baseline Damage Detection using a Low Power Guided Waves System, *Proc. IWSHM*, 2009, pp. 505-512 (9 pp.).
32. Erturk, A., **Anton, S. R.**, Bilgen, O., and Inman, D. J., Effect of Material Constants and Mechanical Damping on Piezoelectric Power Generation, *Proc. ASME IDETC*, 2009 (10 pp.).
33. **Anton, S. R.**, Erturk, A., and Inman, D. J., An Investigation on Multifunctional Piezoelectric Composite Spars for Energy Harvesting in Unmanned Aerial Vehicles, *Proc. ICCM*, 2009 (10 pp.).
34. Erturk, A., **Anton, S. R.**, Kong, N., and Inman, D. J., Self-Powered Boarder Security Systems, *3rd National Security Innovation Competition* (presentations of the finalist universities), May 1, 2009.
35. **Anton, S. R.**, Erturk, A., and Inman, D. J., Piezoelectric Energy Harvesting from Multifunctional Wing Spars for UAVs – Part 2: Experiments and Storage Applications, *Proc. SPIE*, 2009, Vol. 7288, 72880D (12 pp.).
36. Erturk, A., **Anton, S. R.**, and Inman, D. J., Piezoelectric Energy Harvesting from Multifunctional Wing Spars for UAVs – Part 1: Coupled Modeling and Preliminary Analysis, *Proc. SPIE*, 2009, Vol. 7288, 72880C (15 pp.).

^{††} Winner of the *Best Student Paper* award at ASME SMASIS 2009.

37. **Anton, S. R.** and Inman, D. J., Vibration Energy Harvesting for Unmanned Aerial Vehicles, *Proc. SPIE*, 2008, Vol. 6928, 692824 (12 pp.).
38. Schlichting, A. D., **Anton, S. R.**, and Inman, D. J., Motorcycle Waste Heat Energy Harvesting, *Proc. SPIE*, 2008, Vol. 6930, 69300B (8 pp.).
39. **Anton, S. R.**, Erturk, A., Inman, D. J., Energy Harvesting from Small Unmanned Air Vehicles, *17th Intl. Symp. Appl. Ferroelec., 3rd Ann. Energy Harv. Wkshp*, 2008 (2 pp.).
40. Erturk, A., **Anton, S. R.**, and Inman, D. J., Energy Harvesting from Rigid Body Motions, *Proc. ICAST*, 2007 (12 pp.).
41. **Anton, S. R.**, Park, G., Farrar, C. R., Inman, D. J., On Piezoelectric Lamb Wave-Based Structural Health Monitoring using Instantaneous Baseline Measurements, *Proc. SPIE*, 2007, Vol. 6532, 65320B (12 pp.).
42. **Anton, S.**, Butland, A., Carrion, M., Buechler, M., Park, G., Instantaneous Structural Damage Identification Using Piezoelectric-Based Lamb Wave Propagation, *Proc. IMAC*, 2007 (20 pp.).

Master's Thesis

Anton, S. R., 2008, Baseline-Free and Self-Powered Structural Health Monitoring, Master's Thesis, (xiii+154 pages), Department of Mechanical Engineering, Virginia Polytechnic Institute and State University, Blacksburg, VA, USA, June, 2008.

Ph.D. Dissertation

Anton, S. R., 2011, Multifunctional Piezoelectric Energy Harvesting Concepts, Ph.D. Dissertation, (xxv+190 pages), Department of Mechanical Engineering, Virginia Polytechnic Institute and State University, Blacksburg, VA, USA, April, 2011.

INVITED LECTURES/TECHNICAL PRESENTATIONS

Anton, S. R., Smart Knees: The Development of Self-Powered In Vivo Total Knee Replacement Sensors, University of Georgia, Athens, GA, November 11, 2016 (invited lecture).

Kettle, R. A., Dodson, J. C., and **Anton, S. R.**, Experimental Feasibility Study of Microsecond State Detection using Electromechanical Impedance, ASME SMASIS Conference, Stowe, VT, September 30, 2016 (technical presentation).

Anton, S. R., Microsecond State Detection for Real-Time Structural Health Monitoring in Highly Dynamic Environments, Michigan Technological University, Houghton, MI, September 8, 2016 (invited lecture).

Anton, S. R., Continuous, Real-Time State Detection in Highly Dynamic Environments, AFOSR Multi-Scale Structural Mechanics and Prognosis Program Review meeting, Wright Patterson AFB, Dayton, OH, July 20, 2016 (technical presentation).

Anton, S. R., Embedded Piezoelectrics for Sensing and Energy Harvesting in Total Knee Replacement Units, Virginia Tech, Blacksburg, VA, October 9, 2015 (invited lecture).

Anton, S. R., Project-Based Learning Approaches for Cyber-Physical Systems Education, Workshop on 21st Century Cyber-Physical Systems Education, October 3, 2014, National Academy of Sciences, Washington, DC (invited lecture).

Anton, S. R., Smart Materials: An Enabling Technology for Cyber Physical Systems, Los Alamos Dynamics Summer School Lecture, July 29, 2014, Los Alamos National Laboratory, Los Alamos, NM (invited lecture).

Anton, S. R., Piezoelectric Materials & Energy Harvesting, MAT4ENERGY Workshop, June 16, 2014, Grenoble INP - Phelma MINATEC, Grenoble, France (invited lecture).

Anton, S. R., Energy Harvesting: The Development of Self-Powered Electronics, Sigma Xi Research Lecture, November 14, 2013, Tennessee Tech, Cookeville, TN (invited lecture).

Anton, S. R. and Farrar, C. R., Multi-Source Energy Harvesting to Power Remote Sensing Systems, 2013 Los Alamos National Laboratory Postdoc Research Day, June 5, 2013, Los Alamos National Laboratory, Los Alamos, NM (poster presentation).

Anton, S. R. and Farrar, C. R., Multi-Source Harvesting for Remote Power Applications, Los Alamos National Laboratory Engineer's Week Poster Session, February 20, 2013, Los Alamos National Laboratory, Los Alamos, NM (poster presentation).

Anton, S. R., Multifunctional and Multi-Source Energy Harvesting: The Development of Autonomous Low-Power Electronics, February 5, 2013, Tennessee Tech, Cookeville, TN (invited lecture).

Anton, S. R., Energy Harvesting: A Sustainable Approach to Powering Low-Power Electronics, New Mexico State University, Las Cruces, NM, November 29, 2012 (invited lecture).

Anton S. R. and Farinholt, K. M., Piezoelectret Foam-Based Vibration Energy Harvester for Low-Power Energy Generation, 2012 Los Alamos National Laboratory Postdoc Research Day, June 6, 2012, Los Alamos National Laboratory, Los Alamos, NM (poster presentation).

Anton, S. R., Avant, T. D., and Farinholt, K. M., Multi-Source Harvesting for Remote Power Applications, Los Alamos National Laboratory Engineer's Week Poster Session, February 23, 2012, Los Alamos National Laboratory, Los Alamos, NM (poster presentation)

Inman, D. J. and **Anton, S. R.**, Self Charging Sensor Platform, ASME 2011 Applied Mechanics and Materials Conference, Chicago, IL, May 31, 2011 (invited lecture).

Anton, S. R., Smart Materials: An Overview of Research at Virginia Tech, ASME Holston Section Fall Meeting, Kingsport, TN, May 26, 2009 (invited lecture).

FUNDED PROPOSALS

- **PI**, Self-Powered In Vivo Force and Implant Wear Sensing in Knee Arthroplasty, National Institutes of Health, \$417,372, August, 2016 – July, 2019
- **PI**, Enabling Microsecond Condition Monitoring for Real-Time Assessment of Critical Infrastructure, Vibration Institute, \$10,000, May, 2016 – May, 2017
- **PI**, Continuous, Real-Time State Monitoring in Highly Dynamic Environments, Air Force Office of Scientific Research – Young Investigator Research Program (YIP) \$360,000, August, 2016 – July, 2019
- **PI**, Integrated Sensing and Energy Harvesting in Total Knee Replacement Implants, Tennessee Tech University Faculty Research Committee Grant, \$10,000, July, 2015 – June, 2016
- **PI**, Exploring Novel Piezoelectret Polymers for Energy Harvesting, Tennessee Tech University Faculty Research Committee Grant, \$10,000, July, 2014 – June, 2015

INTELLECTUAL PROPERTY

Anton, S. R., Erturk, A., and Inman, D. J., Self-charging structures with flexible piezoceramics and thin-film batteries, Provisional Patent: 61/158,568, March 9, 2009 (expired), Virginia Tech Intellectual Properties: USA.

AWARDS AND HONORS

- Recipient of Rising Renaissance Engineer Faculty Scholar Award from the College of Engineering – Tennessee Tech, 2017
- Recipient of ASME Distinguished Researcher Award from the Tennessee Tech Student Chapter of ASME – Tennessee Tech, 2016
- Recipient of Air Force Summer Faculty Fellowship (AF SFFP) – Tennessee Tech, 2015
- Recipient of Los Alamos Awards Program (LAAP) Award – Los Alamos National Laboratory, 2012

- Recipient of the Graduate Student Service Excellence Merit Certificate – Virginia Tech, 2010-2011
- Overall Conference Winner of the Best Student Paper Competition at the 2009 ASME Smart Materials, Adaptive Structures and Intelligent Systems Conference, Oxnard, CA, September 21-23, 2009
- Virginia Space Grant Consortium Fellowship Recipient – Virginia Tech, 2007, 2008, 2009
- Pratt Fellowship Recipient - Virginia Tech, 2006, 2007, 2008, 2010
- Honorable Mention - National Science Foundation Graduate Research Fellowship, 2006
- Mechanical Engineering Department Scholar - Michigan Technological University, 2006
- President of Pi Tau Sigma, Sigma Iota Chapter - National Mechanical Engineering Honor Society, 2005-2006

Student Awards

- Ph.D. student, Mohsen Safaei, Best Student Hardware Competition – ASME SMASIS Conference – ASME, 2017
- Ph.D. student, Mohsen Safaei, Eminence Award – Outstanding Graduate Research – Tennessee Tech, 2017
- Undergraduate researcher, Rob Ponder, Eminence Award – Outstanding Undergraduate Research – Tennessee Tech, 2017
- Ph.D. student, Mohsen Safaei, awarded best graduate research poster at Annual Student Research and Creative Inquiry Day – Tennessee Tech, 2017
- Undergraduate researcher, Rob Ponder, awarded best undergraduate research poster at Annual Student Research and Creative Inquiry Day – Tennessee Tech, 2017
- M.S. student, Ryan Kettle, National Defense Industrial Association (NDIA) Space and Missile Defense Working Group 2016 Graduate Fellowship - \$5,000 awarded, September, 2016
- Senior Capstone Design Group, Adcock, C., Duke, W., Powelson, M., Schenk, W., and Staggs, H., awarded Best Innovative Capstone Project Award, 2016
- Ph.D. student, Mohsen Safaei, Eminence Award – Outstanding Graduate Research – Tennessee Tech, 2016
- Ph.D. student, Mohsen Safaei, Eminence Award – Doctor of Philosophy Best Paper – Tennessee Tech, 2016
- Ph.D. student, Mohsen Safaei, awarded best graduate research poster at Annual Student Research and Creative Activities Day – Tennessee Tech, 2016
- M.S. student, Ryan Kettle, Eminence Award – Outstanding Teaching Assistant – Tennessee Tech, 2015
- M.S. student, Chase Ray, Eminence Award – Outstanding Graduate Research – Tennessee Tech, 2015
- Undergraduate researcher, Cesar Contreras, Eminence Award – Outstanding Undergraduate Research – Tennessee Tech, 2015
- M.S. student, Chase Ray, awarded best graduate research poster at Annual Student Research Day – Tennessee Tech, 2015
- Undergraduate researcher, Cesar Contreras, awarded best undergraduate research poster at Annual Student Research Day – Tennessee Tech, 2015
- Undergraduate researcher, April Parkison, Rising Renaissance Engineer Spectrum Award – Tennessee Tech, 2015

PROFESSIONAL MEMBERSHIP

ASME – American Society of Mechanical Engineers
SPIE - The International Society for Optics and Photonics
ASEE – American Society of Engineering Education

SERVICE TO THE PROFESSION

Technical Committee Membership and Leadership Roles

ASME Aerospace Division, Adaptive Structures & Material Systems Branch – Member, 2012 – present

ASME Aerospace Division, Technical Committee on Energy Harvesting – Co-Chair, 2017-2018; Secretary, 2016-2017; Member, 2012 – present

Reviewer For:

Journal of Intelligent Material Systems and Structures, SAGE
Smart Materials and Structures, IOP Science
Applied Physics Letters, AIP Publishing
Journal of Sound and Vibration, Elsevier
IEEE/ASME Transactions on Mechatronics, IEEE/ASME
Journal of Applied Mechanics, ASME
IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control, IEEE
Structural Control and Health Monitoring, Wiley
Composites Science and Technology, Elsevier
Phase Transitions, Taylor & Francis
Molecular Diversity Preservation International (MDPI) – Sensors Journal, MDPI
ASME – Smart Materials, Adaptive Structures and Intelligent Systems (SMASIS) Conference, ASME
ASME – International Design Engineering Technical Conference, ASME

Conference Symposium Chair

ASME Smart Materials, Adaptive Structures, and Intelligent Systems (SMASIS) 2017: Symposium 7 – Energy Harvesting (co-chair)
ASME Smart Materials, Adaptive Structures, and Intelligent Systems (SMASIS) 2016: Symposium 7 – Energy Harvesting (chair)
ASME Smart Materials, Adaptive Structures, and Intelligent Systems (SMASIS) 2015: Symposium 7 – Energy Harvesting (co-chair)

Conference Program Committee Membership

SPIE Smart Structures/NDE: Industrial and Commercial Applications of Smart Structures Technologies (2013 – present)
SPIE Smart Structures/NDE: Active and Passive Smart Structures and Integrated Systems (2016-present)

Conference Session Chair

ASME Smart Materials, Adaptive Structures, and Intelligent Systems (SMASIS) 2017: Elastic and Acoustic Wave Harvesting of Energy Harvesting Symposium
SPIE Smart Structures/NDE 2017: Ultrasonic Methods; How Many Books is Too Many? (in A Tribute Conference Honoring Daniel Inman)
ASME Smart Materials, Adaptive Structures, and Intelligent Systems (SMASIS) 2016: Biological Applications of Energy Harvesting II, and Non-Traditional Design and Transduction II of Energy Harvesting Symposium; Novel Sensing and SHM of Structural Health Monitoring Symposium
SPIE Smart Structures/NDE 2016: Energy Harvesting and Scavenging: Modeling
ASME Smart Materials, Adaptive Structures, and Intelligent Systems (SMASIS) 2015: Nonlinear and Broadband Energy Harvesting I Session and Bio-Inspired and Biological Applications of Energy Harvesting Symposium
SPIE Smart Structures/NDE 2015: Passive and Active Vibration Isolation
ASME Smart Materials, Adaptive Structures, and Intelligent Systems (SMASIS) 2014: Energy Harvesting Under Random and Multi-frequency Inputs
International Modal Analysis Conference (IMAC) 2013: Bio-Dynamics
Advances in Structural Health Management and Composite Structures (ASHMCS) 2012: Keynote Session 3
SPIE Smart Structures/NDE 2011: Aircraft, MAV/UAV, and Morphing Systems

Conference Judge

- International Workshop on Structural Health Monitoring (IWSHM) 2017: Best Student Paper Competition Judge
- SPIE Smart Structures/NDE 2013: Best Student Paper Competition Judge
- ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) 2012: Best Student Paper Competition Judge

K-12 STEM EDUCATION OUTREACH EXPERIENCE

Volunteer Referee, FIRST Lego League East Tennessee Championship, Cookeville, TN 2013 – Present

- Volunteering as a referee at the FIRST Lego League (FLL) East Tennessee Championship event held at Tennessee Tech. Refereeing competition matches for the entire event which has about 40 teams.

Workshop Leader, TTU/Eastman East TN FIRST Robotics Workshop, Kingsport, TN 2016

- Collaborated with Eastman's "Putting Children First" program to establish a partnership between TTU and Eastman for STEM outreach through the FIRST Robotics program.
- Hosted the first annual East TN FIRST Robotics Design Brainstorming Workshop at the Regional Center for Advanced Manufacturing (RCAM) in Kingsport, TN, with participation from five teams from the Tri Cities region.

Founder and Lead Engineering Mentor, FIRST Robotics Team 4153 – "Project Y," Los Alamos, NM August 2011 – May 2013

- Co-founded FIRST Robotics Team 4153 in Los Alamos, NM. Raised over \$50k of funding from local businesses and organizations, recruited over 20 students and 15 adult mentors, secured work space and machine shop for team use.
- Acted as lead engineering mentor for the team. Duties included managing volunteer team mentors, conducting engineering lessons for high school students including CAD design, machine shop training, electronics training, and programming, and overseeing robot design and fabrication.
- Team awarded "Rookie Inspiration" award and "Highest Rookie Seed" award at 2012 Utah Regional, Salt Lake City, UT.
- Organized outreach events in the local community to spread the ideals of FIRST robotics.

Instructor, University Explorations Program, University of New Mexico – Los Alamos, Los Alamos, NM August, 2012

- Taught by invitation a week-long summer course called "University Explorations" with 15 students in grades 7-12 at the University of New Mexico – Los Alamos.
- Designed the curriculum, organized the purchase of TETRIX robotics kits for the students to use during the course, and taught the course with the help of two student aids I selected from my FIRST Robotics team.

Lead Programming Mentor – FIRST Robotics Team 401 – "Hokie Guard", Blacksburg, VA August, 2008 – May, 2011

- Acted as a technical mentor for FIRST Robotics Team 401, leading the programming subteam.
- Mentoring activities included preparing graded project assignments for the high school students including mouse trap car competitions and LEGO Mindstorms NXT programming projects, as well as acting as lead mentor for the programming team while designing and building the competition robot.
- My work with Team 401 resulted in my receiving the Graduate Student Service Excellence Merit Certificate at Virginia Tech

Advisor, Student Research Project – Montgomery County Public Schools, VA August, 2009 – June, 2010

- Acted as a project advisor for two high school seniors participating in a student research project focusing on the development of a configurable robotics platform for cost-effective technical education in secondary schools.

- Advising activities included the development of a yearlong curriculum spanning the lifetime of the program, daily guidance on project challenges, and offering of technical knowledge on the topic of robotics and programming.