ONUR BILGEN

Curriculum Vitae

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EDUCATION

Ph.D. (2010) in Mechanical Engineering, Virginia Tech (advisors: Daniel J. Inman, Kevin B. Kochersberger)
M.S. (2007) in ME, Virginia Tech (advisors: Andrew J. Kurdilla, D. J. Inman, K. B. Kochersberger)
B.S. (2005) in ME, Virginia Tech (*magna cum laude in honors – Commonwealth Scholar*)

ACADEMIC INTERESTS

As an academic, my vision is to incorporate the multi-functionality of solid-state smart-materials into mechanical, aerodynamic and biomechanical applications by conducting advanced research, teaching and advising at the undergraduate and graduate levels. During my research and teaching career, I've had the opportunity to participate in a variety of multidisciplinary research areas related to coupled aerodynamic, mechanical and electrical engineering fields. Some of these areas include modal analysis, vibration energy harvesting, structural mechanics, smart material systems and electromechanical morphing wing aircraft. In addition, I have been active in expanding my research interests into the area of medicine and biology by earning an NSF fellowship and attending the ASME 1st Global Congress on NanoEngineering for Medicine and Biology. I have a strong interest in coupling smart material based structures in biological systems, soft (compliant) robotics and mechatronics. As a research scientist with fundamental understanding of solid and fluid mechanics as well as electronics (and their interaction), I have the necessary fundamental tools to make impact in advanced scientific research in the scale of several micrometers up to the scale of several meters. My growing interest in research is the application of basic design and analysis principles of continuum mechanics and electronics to *structures and vehicles* that are capable of transportation and release of treatment drugs to localized areas in the human body.

ACADEMIC EXPERIENCE

Assistant Professor

Old Dominion University, Mechanical and Aerospace Engineering Department, Virginia, USA, from July 2012

- Continuing research on multi-scale, variable-fidelity modeling, optimization and experimental characterization of smart-material-actuated structures
- Teaching Dynamics / Vibrations classes offered at the MAE Department
- Advising graduate and undergraduate students

Research Officer (Post-Doctoral)

Swansea University, College of Engineering, United Kingdom, September 2010 – July 2012

- Conducted research on multi-scale, variable-fidelity modeling, optimization and experimental characterization of smart-material-actuated structures funded by the European Research Council with Prof. Michael I. Friswell as the primary investigator
- Co-advised a senior design project for the aerospace curriculum in the 2011 2012 academic year; project title is "Design and Testing of a Small Scale Smart-Material Based Morphing Airfoil," Fall 2011 Spring 2012
- Assistant lecturer in the junior level Dynamics / Vibrations class taught by Prof. Sondipon Adhikari at the College of Engineering, Swansea University, Spring 2011 and Spring 2012
- Co-advised two senior students in their final project related to static aeroelasticity and vibration energy harvesting with Prof. Michael. I Friswell, Fall 2010 Spring 2011

Graduate Research Assistant

Virginia Tech, Mechanical Engineering Department, Virginia, USA, January 2006 - August 2010

- Advised a senior design team to develop a servo-less unmanned aircraft using piezocomposites, 2009-2010
- Co-managed the Center for Intelligent Material Systems and Structure (CIMSS) Laboratory, 2008 2010
- Co-lecturer for a graduate level Morphing Aircraft class at the University of Maryland and Virginia Tech taught by Dr. Daniel J. Inman and Dr. James E. Hubbard. Conducted four guest-lectures, assigned and graded homework and exam questions, Fall 2009
- Advised and collaborated with a summer intern to develop a microcontroller based piezocomposite airfoil demonstrator, Summer 2009
- Developed models and prototypes of several novel variable-camber airfoils to be used in a ducted-fan aircraft under Air Force Research Laboratory (AFRL) project, through a Phase II SBIR contract with AVID LLC, Spring 2006 – Spring 2008
- Developed a novel piezocomposite morphing wing aircraft under the JOUSTER Program, Fall 2006 Spring 2007

Graduate Teaching Assistant

Virginia Tech, Mechanical Engineering Department, Virginia, USA, August 2005 - December 2005

• Assistant lecturer and grader for the senior level ME 4006 Air Conditioning Lab sections

BOOK CHAPTERS

- Bilgen, O., Inman, D. J., Kochersberger, K. B., submitted, "Chapter 21: Wing-Morphing Design Utilizing Macro-Fiber Composites" chapter in *Mechanics and Design of Smart Composites* (CRC Press, Taylor and Francis), to be published in 2012.
- Bilgen, O., Barbarino, S., Friswell, M.I., submitted, "Static-Aeroelastic Optimization of Surface Actuated Variable-Camber Piezocomposite Morphing Wings," chapter in *Current Trends in Smart Technologies* (Fraunhofer Technical Publication Series), to be published in 2012.

JOURNAL PUBLICATIONS

- Arrieta, A. F., Bilgen, O., Friswell, M. I. and Hagedorn, P., 2012, "Passive load alleviation bi-stable morphing concept," AIP Advances, accepted on July12, 2012.
- Bilgen, O., Friswell, M. I., "Implementation of a Continuous-Inextensible-Surface Piezocomposite Airfoil," *Journal of Aircraft*, accepted on June 26, 2012.
- Friswell, M. I., Ali, S. F., Bilgen, O., Adhikari, S., Lees, A. W. and Litak, G., 2011, "Nonlinear Piezoelectric Vibration Energy Harvesting from an Inverted Cantilever Beam with Tip Mass," *Journal of Intelligent Material Systems and Structures*, accepted on June 18, 2012.
- Arrieta, A. F., Bilgen, O., Friswell, M. I. and Hagedorn, P., 2012 "Morphing dynamic control for bi-stable composites,' special issue in *Journal of Intelligent Material Systems and Structures*, accepted April 28, 2012. doi: 10.1177/1045389X12449918
- Bilgen, O., Butt, L. M., Day, S. R., Sossi, C. A., Weaver, J. P., Wolek, A., Mason, W. H. and Inman, D. J., "A Novel Unmanned Aircraft with Solid-State Control Surfaces: Analysis and Flight Demonstration," *Journal of Intelligent Material Systems* and Structures, submitted April 2, 2012.
- Borowiec, M., Litak, G., Friswell, M. I., Ali, S. F., Adhikari, S., Lees, A. W. and Bilgen, O., "Energy Harvesting in Piezoelastic Systems Driven by Random Excitations," *International Journal of Structural Stability and Dynamics*, submitted March 11, 2012.
- Arrieta, A. F., Bilgen, O., Friswell, M. I. and Hagedorn, P., "Modeling and configuration control of multi-stable piezoelectric composites," in preparation, to be submitted to *Smart Materials and Structures*, 2012.
- Bilgen, O., Wang, Y. and Inman, D. J., 2012, "Electromechanical Comparison of Cantilevered Beams with Multifunctional Piezoceramic Devices," *Mechanical Systems and Signal Processing*, Vol. 27, pp. 763-777, doi:10.1016/j.ymssp.2011.09.002.

- Karami, M. A., Bilgen. O., Inman, D. J. and Friswell, M. I., 2011, "Experimental and Analytical Parametric Study of Single Crystal Unimorph Beams for Vibration Energy Harvesting," *Transactions on Ultrasonics, Ferroelectrics, and Frequency Control*, Vol. 58, No. 7, pp. 1508-1520. doi: 10.1109/TUFFC.2011.1969
- Bilgen, O., Inman, D. J. and Friswell, M. I., 2011, "Theoretical and Experimental Analysis of Hysteresis in Piezocomposite Airfoils Using the Classical Preisach Model," *Journal of Aircraft*, Vol. 48, No. 6, pp. 1935-1947. doi: 10.2514/1.56694
- Barbarino, S., Bilgen, O., Ajaj, R. M., Friswell, M. I. and Inman, D. J., 2011, "A Review of Morphing Aircraft," Journal of Intelligent Material Systems and Structures, Vol. 22, No. 9, pp. 823-877. doi: 10.1177/1045389X11414084
- Bilgen, O., Karami, M. A., Inman, D. J. and Friswell, M. I., 2011, "The Actuation Characterization of Cantilevered Unimorph Beams with Single Crystal Piezoelectric Materials," *Smart Materials and Structures*, Vol. 20, No. 5, 055024. doi: 10.1088/0964-1726/20/5/055024
- Bilgen, O., De Marqui Junior, C., Kochersberger, K. B. and Inman, D. J., 2011, "Macro-Fiber Composite Actuators for Flow Control of a Variable Camber Airfoil," *Journal of Intelligent Material Systems and Structures*, Vol. 22, No. 1, pp. 81-91.
- Bilgen, O., Kochersberger, K. B., Inman, D. J. and Ohanian, O. J., 2010, "Lightweight High Voltage Electronic Circuits for Piezoelectric Composite Actuators," *Journal of Intelligent Material Systems and Structures*, Vol. 21, No. 14, pp. 1417-1426. doi: 10.1177/1045389X10381657
- Bilgen, O., De Marqui Junior, C., Kochersberger, K. B. and Inman, D. J., 2010, "Piezoceramic Composite Actuators for Flow Control in Low Reynolds Number Airflow," *Journal of Intelligent Material Systems and Structures*, Vol. 21, No. 12, pp. 1201-1212.
- Bilgen, O., Erturk, A. and Inman, D.J., 2010, "Analytical and Experimental Characterization of Macro-Fiber Composite Actuated Thin Clamped-Free Unimorph Benders," *Journal of Vibration and Acoustics*, Vol. 132, 051005-1.
- Bilgen, O., Kochersberger, K. B., Inman, D. J. and Ohanian, O. J., 2010, "Macro-Fiber Composite Actuated Simply-Supported Thin Morphing Airfoils," *Smart Materials and Structures*, Vol. 19, 055010. doi:10.1088/0964-1726/19/5/055010
- 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*, Vol. 93, 224102.
- Bilgen, O., Kochersberger, K. B., Inman, D. J. and Ohanian, O. J., 2010, "Novel, Bi-Directional, Variable Camber Airfoil via Macro-Fiber Composite Actuators," *Journal of Aircraft*, Vol. 47, No. 1, pp. 303-314. doi: 10.2514/1.45452
- Bilgen, O., Kochersberger, K. B. and Inman, D. J., 2009, "Macro-Fiber Composite Actuators for a Swept Wing Unmanned Aircraft," Aeronautical Journal, Special issue on Flight Structures Fundamental Research in the USA, publication of Royal Aeronautical Society, Vol. 113, No 1144.

CONFERENCE PAPERS and PRESENTATIONS

- Bilgen, O., Saavedra Flores, E. I. and Friswell, M. I., 2012 "Implementation of a Continuous-Inextensible-Surface Piezocomposite Airfoil," 20th AIAA/ASME/AHS Adaptive Structures Conference, 23–26 April 2012, Honolulu, HI, paper AIAA-2012-1902.
- Arrieta, A. F., Bilgen, O., Friswell, M. I. and Hagedorn, P., 2011, "Morphing dynamic control for bi-stable composites," 22nd International Conference on Adaptive Structures and Technologies (ICAST), Corfu, Greece.
- Bilgen, O., Saavedra Flores, E. I. and Friswell, M. I., 2011, "Optimization of Surface-Actuated Piezocomposite Variable-Camber Morphing Wings," ASME 2011 Conference on Smart Materials, Adaptive Structures and Intelligent Systems (SMASIS2011), Scottsdale, AZ.
- Bilgen, O., Barbarino, S. and Friswell, M. I., 2011, "Static Aeroelastic Optimization of Surface Actuated Variable-Camber Piezocomposite Morphing Wings," Invited plenary session talk at the 5th ECCOMAS Thematic Conference on Smart Structures and Materials (SMART'11), Saarbrücken, Germany.
- Bilgen, O., Friswell, M. I., Kochersberger, K. B. and Inman, D. J., 2011, "Surface Actuated Variable-Camber and Variable-Twist Morphing Wings Using Piezocomposites," 19th AIAA/ASME/AHS Adaptive Structures Conference, Denver, CO.
- Bilgen, O., Butt, L. M., Day, S. R., Sossi, C. A., Weaver, J. P., Wolek, A., Mason, W. H. and Inman, D. J., 2011, "A Novel Unmanned Aircraft with Solid-State Control Surfaces: Analysis and Flight Demonstration," 52nd AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials, Denver, CO.
- Butt, L., Bilgen, O., Day, S., Sossi, C., Weaver, J., Wolek, A., Inman, D.J. and Mason, W.H., 2010, "Wing Morphing Design Utilizing Macro Fiber Composite," Society of Allied Weight Engineers (SAWE) 69th Annual Conference, Virginia Beach, VA, Paper Number 3515-S.
- Bilgen, O., 2010, "Lightweight High Voltage Electronic Circuits for Piezoelectric Composite Actuators," Presentation at the Second Annual Center for Intelligent Material Systems and Structures (CIMSS) Conference, Roanoke, VA.

Attended the ASME 1st Global Congress on NanoEngineering for Medicine and Biology, Houston, Texas, February 7-10, 2010.

- Bilgen, O., De Marqui, C., Kochersberger, K. B. and Inman, D. J., 2009, "Flow Control via Piezoceramic Actuators with an Application to a Variable-Camber Airfoil via MFCs," Paper and Poster Presentation, 20th International Conference on Adaptive Structures and Technologies, Hong-Kong, China.
- Erturk, A., Anton, S. R., Bilgen, O. and Inman, D. J., 2009, "Effect of Material Constants and Mechanical Damping on Piezoelectric Power Generation," ASME 2009 International Design Engineering Technical Conferences & Computers And Information In Engineering Conference IDETC/CIE 2007, San Diego, CA.
- Bilgen, O., Kochersberger, K. B. and Inman, D. J., 2009, "Piezoceramic Actuated Variable-Camber Airfoils: Design, Modeling and Testing," Presentation at the 1st Annual Center for Intelligent Material Systems and Structures (CIMSS) Conference, Blacksburg, VA.
- Bilgen, O., Ohanian, J. O., Kochersberger, K. B. and Inman, D. J., 2009, "Novel, Bi-Directional, Variable Camber Airfoil via Macro-Fiber Composite Actuators," AIAA 2009-2133, 50th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Palm Springs, CA.
- Inman, D. J., Erturk, A. and Bilgen, O., 2008, "Morphing, monitoring and harvesting using smart materials," XII International Conference on Mechanical Engineering, L. Starek, B. Hučko (Eds.), Bratislava, Slovakia.
- 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, SMASIS2008, Ellicott City, MD.
- 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," 19th International Conference on Adaptive Structures and Technologies, Ascona, Switzerland.
- 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," 19th International Conference on Adaptive Structures and Technologies, Ascona, Switzerland.
- Bilgen, O., Kochersberger, K. B. and Inman, D. J., 2008, "A Novel Aerodynamic Vectoring Control Airfoil via Macro-Fiber-Composite Actuators," AIAA-2008-1700, 49th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Schaumburg, IL.
- Bilgen, O., Kochersberger, K. B. and Inman, D. J., 2008, "An Experimental and Analytical Study of a Flow Vectoring Airfoil via Macro-Fiber-Composite Actuators," Proc. of SPIE Vol. 6930, SPIE Smart Structures & NDE 2008, San Diego, CA.
- Bilgen, O., Kochersberger K. B., Diggs, E. C., Kurdilla, A. J. and Inman, D. J., 2007, "Development and Testing of a Macro Fiber Composite Actuated Unmanned Air Vehicle," Presentation at the IKTS ISPA 2007 Conference, Dresden, Germany.
- Bilgen, O., Kochersberger, K., Diggs, E. C., Kurdilla, A. J. and Inman, D. J., 2007, "Morphing Wing Aerodynamic Control via Macro-Fiber-Composite Actuators in an Unmanned Aircraft," AIAA-2007-2741, AIAA Infotech @ Aerospace Conference, Rohnert Park, CA.
- Bilgen, O., Kochersberger, K., Diggs, E. C., Kurdilla, A. J. and Inman, D. J., 2007, "Morphing Wing Micro-Air-Vehicles via Macro-Fiber-Composite Actuators," ASME / Boeing Best Paper Award, AIAA-2007-1785, 48th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, Honolulu, HI.
- Diggs, E. C., Bilgen, O., Kurdila, A. J., Kochersberger, K. B., Inman, D. J. and Vignola, J., 2007, "Structural characteristics via SLDV for a class of morphing micro-air-vehicles," Unmanned Systems Technology IX. Proc. SPIE, Volume 6561, pp. 65611F.
- Bilgen, O., Inman, D. J., Kurdilla, A. J. and Lind, R., 2006, "Active Materials for Wing Morphing Micro-Air-Vehicles," Paper and Poster presentation at the AUVSI's Unmanned Systems North America 2006 Conference, Orlando, FL.

CO-AUTHORED PROPOSALS

- Erturk, A. Ph.D. (co-authors Bilgen, O., Hills, Z., Inman, D. J.) "Theoretical and Experimental Characterization of Fish-like Locomotion Using Different Transduction Techniques," NSF proposal, submitted on Feb 15, 2010.
- Inman, D. J. Ph.D. (co-authors Bilgen, O., Erturk, A.) "Piezocomposites and Shape Changing Multifunctional Surfaces" Proposal Submitted to B. L. ("Les") Lee, ScD Program Manager for Mechanics of Multifunctional Materials & Microsystems, Air Force Office of Scientific Research, AFOSR/NA, Arlington, VA, 2008.
- Kochersberger, K. B. Ph.D. (co-authors Bilgen, O., Inman, D. J.) "Adaptive Camber Control using Macro-Fiber Composite Actuators," Virginia Tech, Blacksburg, VA, 2008.

AWARDS AND FELLOWSHIPS

- **BOEING Engineering Student of the Year 2010 Award:** 3rd place in the BOEING Flightglobal Achievement Awards 2010.
- **NSF Fellowship** for ASME 1st Global Congress on NanoEngineering for Medicine and Biology, Houston, Texas, February 7-10, 2010.
- ASME / BOEING 2008 Structures & Materials Award: Best Paper Award for the paper "Morphing Wing Micro-Air-Vehicles via Macro-Fiber-Composite Actuators" presented at the AIAA SDM 2007 Conference, Honolulu, HI, April 23-26, 2007.

Virginia Tech College of Engineering Fellowship, 2005-2006.

Virginia Tech University Honors Student, Commonwealth Scholar with Magna Cum Laude.

Virginia Tech Eleanor Davenport Leadership Scholarship, 2004-2005.

Virginia Tech Edward H. Cahill Memorial Scholarship, 2003-2004.

Virginia Tech Dean's List, Fall 2002 - Spring 2005.

George Washington University Dean's Honor List, Spring 2002.

George Washington University Presidential Achievement Scholarship, Fall 2002, Spring 2003.

JOURNAL REVIEWS

- Transactions on Mechatronics, IEEE / ASME
- Journal of Intelligent Material Systems and Structures, SAGE
- Journal of Composite Materials, SAGE
- Journal of Aircraft, AIAA
- Journal of Guidance, Control, and Dynamics, AIAA
- Journal of Vibration and Acoustics, ASME