

## Darren J. Hartl, Ph.D.

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### Education

Ph.D. Aerospace Engineering, Texas A&M University, December 2009  
Dissertation: *Modeling of Shape Memory Alloys Considering Rate-Independent and Rate-Dependent Irrecoverable Strains*, Advisor: Dimitris C. Lagoudas  
GPR: 4.00

B.S. Aerospace Engineering, Texas A&M University, May 2004  
GPR: 3.94, *Summa Cum Laude*

### Employment/Appointments

Texas A&M University, College Station, TX

Assistant Professor, Dept. of Aerospace Engineering, Aug. 2016–present  
TEES Research Assistant Professor, Dept. of Aerospace Engineering, Apr. 2011–Jul. 2016  
Assistant Director, Aerospace Vehicles Systems Institute, Dec. 2012–Sep. 2014  
Director of Operations, Texas Institute for Intelligent Materials and Structures (TiiMS),  
July 2012–Sep. 2014  
Senior Research Associate, Dept. of Aerospace Engineering, Oct. 2009–Mar. 2011

Air Force Research Labs, Wright-Patterson AFB, Dayton, OH

Distinguished Engineer, RXCC (Universal Technology Corporation), Oct. 2015–Aug. 2016  
Visiting Researcher, RQVC, Dec. 2014–Present  
Research Scientist, RXCC (UES, Inc.), Oct. 2014–Oct. 2015

Technical University Dortmund, Dortmund, Germany

Visiting Scholar, Institute for Mechanics, June 1–30 2012

American Airlines, Fort Worth, TX

Power Plant Engineer - Co-op, May–Dec. 2002  
Structures Engineer - Co-op, June–Dec. 2001

### Awards and Honors

- *Gary Anderson Early Achievement Award*, presented by ASME Aerospace Division, 2016
- Member, *Distinguished Aerospace Engineering Alumni Academy*, presented by Texas A&M University Department of Aerospace Engineering, 2015

- *Outstanding Young Aerospace Engineer Award*, presented by Texas A&M University Department of Aerospace Engineering, 2015
- *Best Student Paper/Presentation Award, 2nd Place (Advisor)*, presented by ASME at SPIE Smart Conference, 2015
- *Engineering Genesis Award for Multidisciplinary Research (Team Member)*, presented by Texas A&M Engineering Experimentation Station (TEES), 2014.
- *The Computer and Graphics SMI 2013 Best Paper Award (Honorable Mention)*, presented by *Computer and Graphics*, 2013
- *Distinguished Graduate Student Award for Excellence in Doctoral Research* presented by Texas A&M University Association of Former Students, 2010
- *Best Student Paper/Presentation Award*, presented by ASME at SPIE Smart Structures Conference, 2009
- *2008 Best Paper Award*, presented at ASME-SMASIS Conference, 2008
- *William Sweet Smith Prize* presented for best aerospace paper, Journal of the Institute of Mechanical Engineers, 2007
- *Best Student Paper/Presentation Award (Honorable Mention)* presented by ASME at SPIE Smart Structures Conference, 2008
- *NSF Integrative Graduate Education and Research Traineeship (IGERT) Fellowship*, 2007–2009
- *National Defense Science and Engineering Grant (NDSEG) Fellowship*, 2004 – 2007
- *Outstanding Senior Award* presented by Sigma Gamma Tau to the regional senior of the year (1 of 6 nationwide), 2004
- *Stan H. Lowy Award for Excellence in Airplane Design*, 2004
- Tau Beta Pi – Engineering Honor Society
- Sigma Gamma Tau – Aerospace Engineering Honor Society
- Phi Kappa Phi

## I. Teaching/Advising

### I.1. Academic Courses

- *Mechanics of Active Materials* (Graduate)
- *Aerospace Structural Design* (Undergraduate)

### I.2. Short Courses

1. *Introduction to Shape Memory Alloys*, The Boeing Company, Seattle, Washington, March 2009.
2. *Derivation and Implementation of Shape Memory Alloy Constitutive Models*, Department of Mechanical Engineering and Aeronautics, The University of Patras, September 2009.
3. *Materials Simulation at the Continuum Level*, IIMEC Winter School 2012, Texas A&M University, College Station, TX, January 2012 (20 students).

4. *Introduction to the Modeling and Analysis of Active Materials*, Doctoral Training Centre, Advanced Composites Centre for Innovation and Science, Bristol University, Bristol, UK, November 2012 (12 students).
5. *Continuum Response of Microstructures*, IIMEC Summer School 2014, Texas A&M University, College Station, TX, June 2014 (20 students).

### I.3. Graduate Students Advised

#### Masters of Science

- Stephen Oehler, *Developing Methods for Designing Shape Memory Alloy Actuated Morphing Aerostructures* (December 2012; co-advised w/ Lagoudas\*)
- Stephen Cornell, *Experimental Characterization of Shape Memory Alloys Using Digital Image Correlation and Infra-Red Thermography* (May 2015; co-advised w/ Lagoudas\*)
- Aaron Powledge, *Experimental Characterization and Validated Multi-Fidelity Analysis of the Curvature of Shape Memory Alloy Composite Sheets* (May 2015; co-advised w/ Malak)
- Tyler Halbert, *IGP: An Improved Algorithm for Sequential Information Gathering Decisions in Design Under Uncertainty* (May 2015; co-advised w/ Malak)
- \*\*Christopher Bertagne, *Experimental Evaluation of an Analysis Framework for Simulating the Coupled Behavior of Shape Memory Alloy-Based Morphing Radiators* (August 2016; co-advised w/ Whitcomb\*)
- †Brent Bielefeldt, *Computational Analysis of Shape Memory Alloy Sensory Particles for Structural Health Monitoring Applications* (August 2016); co-advised w/ Benzerga\*)
- \*\*\*William Scholten *Analysis and Wind Tunnel Testing of a SuperElastic Slat-Cove Filler For Airframe Noise Reduction* (December 2016)
- Doe Young Hur (August 2017, co-advised with Malak)
- Ryan Patterson (December 2017 expected)
- Jacob Mingear (May 2018 expected)

#### Doctor of Philosophy

- Edwin Peraza Hernandez *Kinematics, Structural Mechanics, and Design of Origami Structures with Smooth Folds* (December 2017 expected; co-advised w/ Lagoudas)
- †Brent Bielefeldt (May 2018 expected)
- Pedro Camara Leal (May 2018 expected)
- \*\*\*William Scholten (May 2018 expected)

\*“Research Faculty” appointment allowed co-advisor status only; these students recruited, fully supported, and primarily technically advised by Hartl

\*\*NASA Space Technology Research Fellow (NSTRF)

\*\*\*NSF Graduate Research Fellow

†DoD SMART Fellow selection

#### I.4. Graduate Student Committees

##### Masters of Science

Isaac Reese (May 2013, MEEN); Shane Bearrow (May 2013, ARCH); Benita Mordi (December 2015, ISEN); Rajiv Jay (December 2015, ELEN); John Rohmer (August 2016, AERO)  
Alim Kim (August 2017, AERO)

##### Doctor of Philosophy

Edgar Galvan (August 2016 expected, MEEN); Robert Wheeler (May 2017 expected)

#### I.5. Undergraduate Research for Credit Mentees

Judy Santa Cruz (Summer & Fall 2012); Klaus Lima (Fall 2012); William Scholten (Honors, Spring 2013); Flavia Ohara (Spring & Summer 2013); Christopher Bertgane (Honors, Fall 2013); Daniel Whitten (Honors, Fall 2013); Joshua Herrington (Honors, Spring 2014); Logan Hodge (Honors, Spring 2014); Nicholas Page (Honors, Spring 2016)

#### I.6. Visiting Student Scholar Mentees

##### Bachelors Thesis / Masters of Science

Florent Righi (École Supérieure des Sciences et Techniques de l'Ingénieur de Nancy, Mar–Aug 2012); Robin Schulte (Technical University Dortmund, Aug–Oct 2013); Thibaut Brosse (Ecole nationale d'Ingénieurs de Saint-Etienne (ENISE), Feb–Aug 2014); Fan Fei (Harbin Institute of Technology, Feb–Jun 2014); Clément Nony-Davadie (Arts et Métiers ParisTech), May–Sept 2014); Jeff Volpi (Ecole nationale d'Ingénieurs de Saint-Etienne (ENISE), Sep 2015–Jan 2016); Quentin Chapelon (Ecole nationale d'Ingénieurs de Saint-Etienne (ENISE), Feb 2016–Jun 2016)

##### Doctor of Philosophy

Alex Solomou (University of Patra, Jun-Aug 2011, Jun-Aug 2014); Theodoros Machairas (University of Patra, Jun-Aug 2012); Giulia Scalet (University of Pavia, Jun-Aug 2013)

## II. Research

### II.1. Book Chapters

1. D. Hartl, D. Lagoudas, *Thermomechanical Characterization of Shape Memory Alloys*, In D. Lagoudas (Ed.), *Shape Memory Alloys: Modeling and Engineering Applications*, Springer, 2008, pp. 55–124.
2. M. Qidwai, D. Lagoudas, D. Hartl, *Numerical Implementation of an SMA Thermomechanical Constitutive Model Using Return Mapping Algorithms*, In D. Lagoudas (Ed.), *Shape Memory Alloys: Modeling and Engineering Applications*, Springer, 2008, pp. 193–236.
3. J. Schick, D. Hartl, D. Lagoudas, *Incorporation of Shape Memory Alloy Actuators into Morphing Aerostructures*, In J. Valasek (Ed.), *Morphing Aerospace Vehicles and Structures*, Wiley, 2012

### II.2. Papers in Refereed Journals

1. D. Hartl, D. Lagoudas, *Aerospace Applications of Shape Memory Alloys*, Proceedings of the Institution of Mechanical Engineers, Part G, *Journal of Aerospace Engineering*, Vol. 221 (Winner of the William Sweet Smith Prize), pp. 535–552, 2007.

2. D. Hartl, D. Lagoudas, *Constitutive Modeling and Structural Analysis Considering Simultaneous Phase Transformation and Plastic Yield in Shape Memory Alloys*, Smart Materials and Structures, Vol. 18, No. 10, 2009. (IF: 2.44)
3. D. Hartl, D. Lagoudas, J. Mabe, F. Calkins, *Use of Ni60Ti Shape Memory Alloy for Active Jet Engine Chevron Application, Part I: Thermomechanical Characterization*, Smart Materials and Structures, Vol. 19, No. 1, 2010. (IF: 2.769)
4. D. Hartl, J. Mooney, D. Lagoudas, J. Mabe, F. Calkins, *Use of Ni60Ti Shape Memory Alloy for Active Jet Engine Chevron Application, Part II: Experimentally Validated Numerical Analysis*, Smart Materials and Structures, Vol. 19, No. 1, 2010. (IF: 2.769)
5. D. Hartl, G. Chatzigeorgiou, D. Lagoudas, *Three-Dimensional Modeling and Numerical Analysis of Rate-Dependent Irrecoverable Deformation in Shape Memory Alloys*, International Journal of Plasticity, Vol. 26, No. 10, pp. 1485–1507, 2010. (IF: 4.36)
6. D. Hartl, D. Lagoudas, F. Calkins, *Advanced Methods for the Analysis, Design, and Optimization of SMA-Based Aerostructures*, Smart Materials and Structures, Vol. 20, 094006, 2011. (IF: 2.769)
7. D. Lagoudas, D. Hartl, Y. Chemisky, L. Machado, P. Popov, *Constitutive Model for the Numerical Analysis of Phase Transformation in Polycrystalline Shape Memory Alloys*, International Journal of Plasticity, Vol. 32–33, pp. 155–183, 2012. (IF: 4.36)
8. S. Oehler, D. Hartl, R. Lopez, R. Malak, D. Lagoudas, *Design Optimization and Uncertainty Analysis of SMA Morphing Structures*, Smart Materials and Structures. Vol. 21, No. 9, 2012. (IF: 2.769)
9. E. Peraza-Hernandez, S. Hu, H-W. Kung, E. Akleman, D. Hartl, *Towards Building Smart Self-Folding Structures*, Computers and Graphics, Vol. 37, No. 6, (Winner of the Computers and Graphics SMI 2013 Best Paper Award, Honorable Mention), 2013.
10. E. Peraza-Hernandez, D. Hartl, R. Malak, *Design and Optimization of an SMA-Based Self-Folding Sheet*, ASME Journal of Mechanical Design, Vol. 135, No. 11, p. 111007, 2013. (IF: 1.56)
11. E. Peraza-Hernandez, D. Hartl, R. Malak, *Design and Numerical Analysis of an SMA Mesh-based Self-Folding Sheet*, Smart Materials and Structures, Vol. 22, 094008, 2013. (IF: 2.769)
12. G. Esquivel, D. Hartl, D. Whitten, *POP-OP: A Shape Memory-Based Morphing Wall*, International Journal of Architectural Computing, Vol. 11, No. 3, 2013.
13. E. Peraza-Hernandez, D. Hartl, R. Malak, D. Lagoudas, *Origami-Inspired Active Structures: A Synthesis and Review*, Smart Materials and Structures (special issue), Vol. 23, No. 9, 2014. (IF: 2.769)
14. D. Hartl, J. Mabe, O. Benafan, A. Coda, B. Conduit, R. Padan, B. Van Doren, *Standardization of Shape Memory Alloy Test Methods Toward Certification of Aerospace Applications*, Smart Materials and Structures, Vol. 24, No. 8, 2015. (IF: 2.769)
15. E. Peraza-Hernandez, B. Kiefer, D. Hartl, A. Menzel, D. Lagoudas, *Analytical Investigation of Structurally Stable Configurations in Shape Memory Alloy-Actuated Plates*, International Journal of Solids and Structures, Vol. 69–70, pp. 442–458, 2015. (IF: 2.04)
16. W. Scholten, D. Hartl, T. Turner, R. Kidd, *Development and Analysis-Driven Design Optimization of an SMA-Based Slat-Cove Filler for Airframe Noise Reduction*, AIAA Journal, Vol. 54, No. 3, 2016. (IF: 1.17)

17. D. Hartl, E. Galvan, R. Malak, J. Baur *Parameterized Design Optimization of a Magneto-hydrodynamic Liquid Metal Active Cooling Concept*, ASME Journal of Mechanical Design, Vol. 138, No. 3, pp. 031402-1–031402-11, 2016. (IF: 1.56)
18. G. Scalet, F. Auricchio, D. Hartl *Efficiency and Effectiveness of Implicit and Explicit Approaches for the Analysis of Shape Memory Alloy Bodies*, Journal of Intelligent Materials Systems and Structures, Vol. 27, No. 3, pp. 384–402, 2016. (IF: 2.17)
19. E. Peraza Hernandez, D. Hartl, R. Malak, Jr., E. Akleman, O. Gonen, H-W. Kung, *Design Tools for Patterned Self-Folding Reconfigurable Structures Based on Programmable Active Laminates*, Mechanisms and Robotics, Vol. 8, No. 3, pp. 031015-1–031015-12, 2016. (IF: 1.14)
20. R. Saunders, J. Boyd, D. Hartl, J. Brown, F. Calkins, D. Lagoudas, *A Validated Model for Induction Heating of Shape Memory Alloy Actuators*, Smart Materials and Structures, Vol. 25, No. 4, 2016. (IF: 2.769)
21. D. Hartl, G. Frank, J. Baur, *Effects of Microchannels on the Mechanical Performance of Multifunctional Composite Laminates with Unidirectional Laminae*, Composite Structures, Vol. 143, No. 5, 2016. (IF: 3.32)
22. T. Halbert, E. Peraza-Hernandez, R. Malak, D. Hartl, *Numerically Validated Reduced-Order Model for Laminates Containing Shape Memory Alloy Wire Meshes*, Journal of Intelligent Materials Systems and Structures, Vol. 27, No. 11, pp. 1492–1509, 2016. (IF: 2.17)
23. A. Solomou, T. Machairas, D. Saravanos, D. Hartl, and D. Lagoudas, *A Coupled Layered Thermomechanical Shape Memory Alloy Beam Element with Enhanced Higher Order Temperature Field Approximations*, Journal of Intelligent Materials Systems and Structures (published online), 2016. (IF: 2.17)
24. D. Hartl, G. Frank, J. Baur, *Embedded Magneto-hydrodynamic Liquid Metal Thermal Transport: Validated Analysis and Design Optimization*, Journal of Intelligent Materials Systems and Structures, (accepted, in press), 2016. (IF: 2.17)
25. E. Peraza Hernandez, D. Hartl, E. Akleman, D. Lagoudas, *Modeling and Analysis of Origami Structures with Smooth Folds*, Computer-Aided Design, (accepted, in press), 2016. (IF: 1.8)
26. E. Peraza Hernandez, D. Hartl, D. Lagoudas, *Kinematics of Origami Structures with Smooth Folds*, Mechanisms and Robotics, (accepted, in press), 2016. (IF: 1.14)
27. D. Hartl, G. Frank, G. Huff, J. Baur, *A Liquid Metal-Based Structurally Embedded Vascular Antenna: I. Concept and Multiphysical Modeling*, Smart Materials and Structures, (submitted), 2016. (IF: 2.769)
28. D. Hartl, G. Frank, R. Malak, J. Baur, *A Liquid Metal-Based Structurally Embedded Vascular Antenna: II. Multiobjective and Parameterized Design Optimization*, Smart Materials and Structures, (submitted), 2016. (IF: 2.769)
29. G. Huff, H. Pan, D. Hartl, G. Frank, R. Bradford, J. Baur, *A Physically Reconfigurable Structurally Embedded Vascular Antenna (SEVA)*, IEEE Transactions on Antennas and Propagation, (submitted), 2016. (IF: 2.053)

#### In Progress

- D. Hartl, B. Kiefer, R. Schulte, A. Menzel, *Modeling Crystalline Inelastic Responses Using an Anisotropic Yield Surface: Applications to Shape Memory Alloys*, planned submission to International Journal of Plasticity, Spring 2016.

- D. Hartl, Y. Chemisky, F. Meraghni, *A Unified Phenomenological Model for Phase Transformation and Associated Fatigue Damage in Shape Memory Alloys*, draft form; planned submission to International Journal of Fatigue, Spring 2016.
- S. Cornell, D. Whitten, D. Hartl, D. Lagoudas, *Optimized Calibration of Shape Memory Alloy Constitutive Models from Heterogeneous Infrared Thermography and Digital Image Correlation Data*, draft form; planned submission to Smart Materials and Structures (invited, special issue), Spring 2016.

\*Special Advised Articles

- D. Whitten, *The Pop-Op Morphing Wall: A Fusion of Engineering and Art*, Explorations: The Texas A&M Undergraduate Journal, Vol. 5, pp.53–56, Fall 2013.

\*strictly reviewed articles that require single student researcher authorship

### II.3. Papers in Conference Proceedings

1. D. Hartl, B. Volk, D. Lagoudas, F. Calkins, J. Mabe, *Thermomechanical Characterization and Modeling of Ni60Ti40 SMA for Actuated Chevrons*, In Proceedings of IMECE 2006 Conference, Nov. 2006, Chicago, pp.1-10.
2. D. Hartl, D. Lagoudas, *Characterization and 3-D Modeling of Ni60Ti SMA for Actuation of a Variable Geometry Jet Engine Chevron*, In Proceedings of SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2007, pp.1-12.
3. D. Hartl, D. Lagoudas, *Simultaneous Transformation and Plastic Deformation in Shape Memory Alloys*, In Proceedings of SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2008, pp.1-12.
4. D. Hartl, D. Lagoudas, *Experimentally Validated Numerical Analysis of Aerostructures Incorporating Shape Memory Alloys*, In Proceedings of SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2008, pp.1-12.
5. D. Hartl, D. Lagoudas, *Analysis of Simultaneous Transformation and Plastic Deformation in Shape Memory Alloys*, In Proceedings of the 19th International Conference on Adaptive Structures and Technologies, Ascona, Switzerland, October, 2008, pp.1-12.
6. D. Hartl, J. Mooney, D. Lagoudas, *Numerically Implemented Constitutive Model for SMA Applications Experiencing General Loads Resulting in Plastic Deformation and Large Rotations*, In Proceedings of ASME 2008 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, Ellicott City, MD. October 2008.
7. D. Hartl, D. Lagoudas, *Experimental Investigation and 3-D Modeling of Rate-Dependent Irrecoverable Deformation in Shape Memory Alloys*, In Proceedings of SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2009, pp.1-12.
8. D. Hartl, D. Lagoudas, *Modeling of Stress Concentrations in SMA Components Considering Plastic and Viscoplastic Yielding*, In Proceedings of 50th AIAA Structures, Structural Dynamics, and Materials Conference, Palm Springs, California, March 2009, pp.1-8.
9. D. Hartl, S. Oehler, D. Lagoudas, *Constitutive Modeling of Phase Transformation and Plastic Yield in SMAs: Application to the S3T-RoundRobin*, In Proceedings of ESOMAT 2009 Conference, Prague, Czech Republic, September 2009, pp. 1–7.
10. D. Hartl, G. Chatzigeorgiou, D. Lagoudas, *Three-Dimensional Modeling of Rate-Dependent Deformation in Shape Memory Alloys at High Temperatures*, In Proceedings of SMASIS

- 2009 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, Oxnard, California, September 2009, pp. 1–8.
11. D. Lagoudas, G. Chatzigeorgiou, D. Hartl, P. Kumar, *Coexistence of Creep and Transformation in High Temperature Shape Memory Alloys*, In Proceedings of IMECE 2009 ASME International Mechanical Engineering Congress & Exposition, Lake Buena Vista, Florida, November 2009, pp. 1–7.
  12. J. Nolan, D. Hartl, D. Lagoudas, *3-D Finite Element Analysis of Indentation Recovery due to the Shape Memory Effect* In Proceedings of SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2010, pp. 1–10.
  13. L. Gravatt, J. Mabe, F. Calkins, D. Hartl, *Characterization of Varied Geometry Shape Memory Alloy Beams* In Proceedings of SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2010, pp. 1–12.
  14. D. Hartl, T. Zimmerman, M. Dilligan, J. Mabe, F. Calkins, *Analysis of Shape Memory Alloy Components Using Beam, Shell, and Continuum Finite Elements*, In Proceedings of SMASIS 2010 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, Philadelphia, Pennsylvania, September–October 2010, pp. 1–11.
  15. S. Oehler, D. Hartl, D. Lagoudas, *Analysis and Optimization of Improved Hybrid SMA Flexures for High Rate Actuation* In Proceedings of SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2011, pp. 1–12.
  16. S. Oehler, D. Hartl, D. Lagoudas, R. Malak, *Design Optimization of a Shape Memory Alloy Actuated Morphing Aerostructure*, In Proceedings of SMASIS 2011 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, Scottsdale, Arizona, September 2011, pp. 1–9.
  17. D. Friedman, S. Bieniawski, D. Hartl, *Simulation and Control Design for Shape Memory Alloy Torque Tubes*, In Proceedings of SMASIS 2011 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, Scottsdale, Arizona, September 2011, pp. 1–11.
  18. S. Oehler, D. Hartl, T. Turner, D. Lagoudas, *Modeling Fluid Structure Interaction with Shape Memory Alloy Actuated Morphing Aerostructures* In Proceedings of SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2012, pp. 1–11.
  19. D. Hartl, A. Solomou, D. Lagoudas, D. Saravanos, *Phenomenological Modeling of Induced Transformation Anisotropy in Shape Memory Alloy Actuators* In Proceedings of SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2012, pp. 1–14.
  20. S. Oehler, D. Hartl, D. Lagoudas, R. Malak, *Design of Morphing SMA Aerostructures by Computational Modeling* In Proceedings of the 23rd International Congress of Theoretical and Applied Mechanics, Beijing, China, August 2012, pp. 1–2.
  21. B. Agboola, D. Hartl, D. Lagoudas, *A Study of Actuation Fatigue of Shape Memory Alloy* In Proceedings of SMASIS 2012 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, Stone Mountain, Georgia, September 2012, pp. 1–7.
  22. G. Atkinson, K. Kirkpatrick, D. Hartl, J. Valasek, *Application of SMA Actuators to Space-suit Glove Mobility* In Proceedings of SMASIS 2012 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, Stone Mountain, Georgia, September 2012, pp. 1–8.
  23. D. Hartl, K. Lane, R. Malak, *Computational Design of a Reconfigurable Origami Space Structure Incorporating Shape Memory Alloy Thin Films* In Proceedings of SMASIS 2012 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, Stone Mountain, Georgia, September 2012, pp. 1–9.



24. M. Tabesh, B. Lester, D. Hartl, D. Lagoudas, *Influence of the Latent Heat of Transformation and Thermomechanical Coupling on the Performance of Shape Memory Alloy Actuators* In Proceedings of SMASIS 2012 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, Stone Mountain, Georgia, September 2012, pp. 1–9.
25. D. Hartl, K. Lane, R. Malak, *Design of a Massively Reconfigurable Origami Space Structure Incorporating Shape Memory Alloys* In Proceedings of IMECE 2012, ASME 2012 International Mechanical Engineering Congress and Exposition, Houston, Texas, November 2012, pp. 1–8.
26. D. Hartl, E. Peraza-Hernandez, D. Lagoudas, *Finite Element Analysis of the Nonlinear Dynamics of a Shape Memory Alloy Structure* In Proceedings of the XV International Symposium on Dynamic Problems in Mechanics (DINAME), Buzios, RJ, Brazil, February 2013, pp. 1–10.
27. D. Hartl, B. Kiefer, A. Menzel, *Modeling Shape Memory Alloy Single Crystalline Responses Using an Anisotropic Yield Surface* In Proceedings of TMS 2013 142nd Annual Meeting and Exhibition, San Antonio, Texas, March 2013, pp. 1–12.
28. J. Mabe, B. Fisher, D. Hartl, *Response of Trained Torsional Actuators Operating under Reverse Bias Loads* In Proceedings of TMS 2013 142nd Annual Meeting and Exhibition, San Antonio, Texas, March 2013, pp. 1–12.
29. D. Sullivan, F. Righi, D. Hartl, J. Rogers *Shape Memory Alloy Rotor Blade Deicing* In Proceedings of the 21st AIAA/ASME/AHS Adaptive Structures Conference, Boston, Massachusetts, April 2013.
30. T. Machairas, D. Hartl, D. Saravanos, D. Lagoudas *Multilevel Optimization of a Morphing Structure Incorporating Shape Memory Alloy Wires* In Proceedings of the 21st AIAA/ASME/AHS Adaptive Structures Conference, Boston, Massachusetts, April 2013.
31. \*\*J. Santa Cruz, D. Hartl, D. Lagoudas *In-Situ Strain Localization Measurements of Shape Memory Alloy Actuators during a Research Experiences for Undergraduates Program* In Proceedings of the 120th ASEE Annual Conference, Atlanta, Georgia, June 2013.
32. \*\*G. Esquivel, D. Hartl, D. Whitten, *“Pop-Op:” A Kinetic Surface*, In Proceedings of Shape Modeling International 2013 (SMI’13), Bournemouth, UK, July 2013.
33. E. Peraza-Hernandez, D. Hartl, D. Lagoudas *Shape Memory Alloy Laminate for Design of Self-Folding Reconfigurable Structures* In Proceedings of the 19th International Conference on Composite Materials, Montreal, July-August 2013.
34. \*\*E. Peraza-Hernandez, D. Hartl, R. Malak *Simulation-Based Design of a Self-Folding Smart Material System* In Proceedings of the ASME 2013 International Design Engineering Technical Conference & Computers and Information in Engineering Conference, Portland, Oregon, August 2013.
35. P. Zhu, C. Brinson, E. Peraza-Hernandez, D. Hartl, E. Stebner, *Comparison of Three-dimensional Shape Memory Alloy Constitutive Models: Finite Element Analysis of Actuation and Superelastic Responses of a Shape Memory Alloy Tube* In Proceedings of ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Snowbird, UT, Sept. 2013, pp. 1–10.
36. R. Wheeler, J. Santa-Cruz, D. Hartl, D. Lagoudas, *Effects of Processing and Loading on Equiatomic Niti Fatigue Life and Localized Failure Mechanisms* In Proceedings of ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Snowbird, UT, Sept. 2013, pp. 1–8.

37. T. Turner, R. Kidd, D. Hartl, W. Scholten, *Development of a SMA-based, Slat-cove Filler for Reduction of Aeroacoustic Noise Associated with Transport-class Aircraft Wings* In Proceedings of ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Snowbird, UT, Sept. 2013, pp. 1–10.
38. W. Scholten, D. Hartl, T. Turner, *Analysis-driven Design Optimization of a SMA-based Slat-cove Filler for Aeroacoustic Noise Reduction* In Proceedings of ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Snowbird, UT, Sept. 2013, pp. 1–10.
39. E. Peraza-Hernandez, D. Hartl, D. Lagoudas, *Modeling of Shape Memory Alloy Wire Meshes Using Effective Lamina Properties for Improved Analysis Efficiency* In Proceedings of ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Snowbird, UT, Sept. 2013, pp. 1–10.
40. S. Cornell, D. Hartl, D. Lagoudas, *Experimental Validation of a Shape Memory Alloy Constitutive Model by Heterogeneous Thermal Loading Using Infrared Thermography and Digital Image Correlation* In Proceedings of ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Snowbird, UT, Sept. 2013, pp. 1–10.
41. K. Lima, M. Savi, D. Hartl *Influence of Temperature Variations on The Vibration of Shape Memory Alloy Structures Using Finite Element Analysis*, In Proceedings of the 22nd International Congress of Mechanical Engineering (COBEM 2013), Ribeiro Preto, SP, Brazil, November 2013
42. L. Lima Junior, M. Savi, D. Hartl, *Morphing Airfoil: Camber Optimization Using Shape Memory Alloys*, In Proceedings of the 22nd International Congress of Mechanical Engineering (COBEM 2013), Ribeiro Preto, SP, Brazil, November 2013
43. E. Peraza-Hernandez, D. Hartl, K. Frei, E. Akleman, *Connectivity of Shape Memory Alloy-based Self-folding Structures*, In Proceedings of AIAA SciTech 2014, National Harbor, MD, January 2014.
44. S. Cornell, W. Leser, V. Gupta, J. Hochhalter, J. Newman, D. Hartl, *Performance Characterization of Aluminum Sensory Alloys*, In Proceedings of the TMS 2014 143rd Annual Meeting and Exhibition, San Diego, CA, March 2014.
45. E. Peraza-Hernandez, K. Frei, D. Hartl, D. Lagoudas, *Folding Patterns and Shape Optimization Using SMA-based Self-Folding Laminates*, In Proceedings of SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2014.
46. D. Hartl, Y. Chemisky, F. Meraghni, *Three-Dimensional Constitutive Model Considering Transformation-Induced Damage and Resulting Fatigue Failure in Shape Memory Alloys*, In Proceedings of SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2014.
47. D. Whitten, D. Hartl, *Iterative Calibration of a Shape Memory Alloy Constitutive Model from 1-D and 2-D Experimental Data Using Optimization Methods*, In Proceedings of SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2014.
48. \*\*T. Halbert, P. Moghadas, R. Malak, D. Hartl, *Control of a Shape Memory Alloy Based Self-Folding Sheet* In Proceedings of the ASME 2013 International Design Engineering Technical Conference & Computers and Information in Engineering Conference, Buffalo, New York, August 2014.
49. \*\*R. Saunders, D. Hartl, R. Malak, D. Lagoudas *Design and Analysis of a Self-Folding SMA-SMP Composite Laminate* In Proceedings of the ASME 2013 International Design

Engineering Technical Conference & Computers and Information in Engineering Conference, Buffalo, New York, August 2014.

50. K. Lima, M. Savi, D. Hartl, D. Lagoudas, *Finite Element Analysis of the Vibration of a Shape Memory Alloy Structure*, In Proceedings of the National Congress of Mechanical Engineering (CONEM 2014), Uberlandia, Brazil, August 2014
51. R. Saunders, D. Hartl, J. Herrington, L. Hodge, J. Mabe, *Optimization of a Composite Morphing Wing with Shape Memory Alloy Torsional Actuators* In Proceedings of ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Newport, RI, Sept. 8–10, 2014.
52. R. Wheeler, J. Santa-Cruz, D. Hartl, Y. Chemisky, D. Lagoudas *Characterization and Modeling of Thermo-Mechanical Fatigue in Equiatomic NiTi Actuators* In Proceedings of ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Newport, RI, Sept. 8–10, 2014.
53. A. Powledge, R. Malak, D. Hartl, *Experimental Analysis of Self-Folding SMA-Based Sheet Design for Simulation Validation* In Proceedings of ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Newport, RI, Sept. 8–10, 2014.
54. S. Cornell, J. Hochhalter, W. Leser, J. Newman, D. Hartl, *Development and Characterization of Embedded Sensory Particles Using a Novel Multi-Scale 3-D Digital Image Correlation Method* In Proceedings of ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Newport, RI, Sept. 8–10, 2014.
55. E. Peraza-Hernandez, A. Kotz, D. Hartl, R. Malak, *Design and Optimization of SMA-based Self-Folding Laminates Considering Sparse Insulating Layers* In Proceedings of ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Newport, RI, Sept. 8–10, 2014.
56. C. Bertagne, P. Moghadas, D. Hartl, R. Malak, *Feedback Control Applied to Finite Element Models of Morphing Structures* In Proceedings of ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Newport, RI, Sept. 8–10, 2014.
57. P. Camara Leal, C. Bertagne, D. Hartl, *Aero-structural Optimization of Shape Memory Alloy-based Wing Morphing via a Class/Shape Transformation Approach*, In Proceedings of AIAA SciTech 2015, Kissimmee, FL, January 2015.
58. C. Bertagne, D. Hartl, T. Cognata, *Analysis of Highly Coupled Thermal-Structural Responses in Morphing Radiative Bodies*, In Proceedings of AIAA SciTech 2015, Kissimmee, FL, January 2015.
59. J. Herrington, L. Hodge, C. Stein, R. Saunders, D. Hartl, J. Mabe, *Development of a Twisting Wing Powered by a Shape Memory Alloy Actuator*, In Proceedings of AIAA SciTech 2015, Kissimmee, FL, January 2015.
60. T. Cognata, D. Hartl, R. Sheth, C. Dinsmore, *A Morphing Radiator for High-Turndown Thermal Control of Crewed Space Exploration Vehicles* , In Proceedings of AIAA SciTech 2015, Kissimmee, FL, January 2015.
61. R. Saunders, D. Hartl, J. Boyd, D. Lagoudas, *Modeling and Development of a Twisting Wing Using Inductively Heated Shape Memory Alloy Actuators* In Proceedings of SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2015.
62. C. Bertagne, J. Whitcomb, D. Hartl, *Simulating Coupled Thermal-Mechanical Interactions in Morphing Radiators* In Proceedings of SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2015.

63. R. Wheeler, D. Hartl, Y. Chemisky, D. Lagoudas, *Modeling of Thermo-Mechanical Fatigue and Damage in Shape Memory Alloy Axial Actuators* In Proceedings of SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2015.
64. J. Rohmer, E. Peraza Hernandez, D. Hartl, J. Boyd, D. Lagoudas, and R. Skelton, *An Experimental and Numerical Study of Shape Memory Alloy-based Tensegrity/Origami Structures*, In Proceedings of ASME 2015 International Mechanical Engineering Congress & Exposition, Houston, November 2015.
65. \*\*P. Moghadas, R. Malak, D. Hartl, *Reinforcement Learning for Control of a Shape Memory Alloy Based Self-Folding Sheet* In Proceedings of the ASME 2013 International Design Engineering Technical Conference & Computers and Information in Engineering Conference, Boston, August 2015.
66. \*\*W. Scholten, D. Hartl, T. Strganac, T. Turner, *Reduction of Actuation Loads In a Self-Deploying SMA-Based Slat-Cove Filler for a Transport Aircraft* In Proceedings of ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Colorado Spring, CO, Sept. 21–23, 2015.
67. \*\*E. Peraza-Hernandez, D. Hartl, R. Malak, D. Lagoudas, *Analysis and Optimization of a Shape Memory Alloy-Based Self-Folding Sheet Considering Material Uncertainties* In Proceedings of ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Colorado Spring, CO, Sept. 21–23, 2015.
68. \*\*B. Bielefeldt, J. Hochhalter, D. Hartl, *Computationally Efficient Analysis of SMA Sensory Particles Embedded in Complex Aerostructures Using a Substructure Approach* In Proceedings of ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Colorado Spring, CO, Sept. 21–23, 2015.
69. C. Bertagne, J. Chong, J. Whitcomb, D. Hartl, L. Erickson, and R. Sheth, *Experimental Characterization of a Shape Memory Alloy-Based Morphing Radiator*, In Proceedings of AIAA SciTech 2016, San Diego, CA, January 2016.
70. D. Hartl, G. Reich, and P. Beran, *Additive Topological Optimization of Muscular-Skeletal Structures via Genetic L-System Programming*, In Proceedings of AIAA SciTech 2016, San Diego, CA, January 2016.
71. C. Bertagne, L. Erickson, R. Sheth, J. Whitcomb, D. Hartl *Experimental Validation of an Analysis Framework for Morphing Radiators* In Proceedings of SPIE Smart Structures and Materials/NDE Conference, Las Vegas, NV, March 2016.
72. B. Bielefeldt, A. Benzerga, D. Hartl *Analysis of Shape Memory Alloy Sensory Particles for Damage Detection via Substructure and Continuum Damage Modeling* In Proceedings of SPIE Smart Structures and Materials/NDE Conference, Las Vegas, NV, March 2016.
73. D. Hartl, G. Huff, H. Pan, L. Smith, R. Bradford, G. Frank, J. Baur, *Analysis and Characterization of Structurally Embedded Vascular Antennas Using Liquid Metals* In Proceedings of SPIE Smart Structures and Materials/NDE Conference, Las Vegas, NV, March 2016.
74. \*\*L. Smith, H. Pan, R. Bradford, G. Frank, D. Hartl, J. Baur, G. Huff, *A Study of Liquid Metal Alloy Reconfigurable Antennas Embedded in a Structural Composite* In Proceedings of 2016 IEEE International Symposium on Antennas and Propagation/USNC-URSI National Radio Science, Fajardo, Puerto Rico, June/July 2016.
75. D. Hartl, G. Frank, G. Huff, J. Baur, *Analysis-Driven Design of Vascular Antennas Embedded in Multifunctional Composites* In Proceedings of the 31st ASC Technical Conference and ASTM D30 Meeting, Williamsburg, VA, September 2016.

76. G. Huff, H. Pan, D. Hartl, G. Frank, R. Bradford, J. Baur, *A Physically Reconfigurable Structurally Embedded Vascular Antenna (SEVA)* In Proceedings of the 54th Annual Allerton Conference on Communication, Control, and Computing, Monticello, IL, September 2016.

Submitted/In Review/Accepted

- G. Huff, H. Pan, D. Hartl, G. Frank, R. Bradford, J. Baur, *Fabrication, multiphysics analysis, and electromagnetic performance of liquid metal antennas embedded in structural composites* In Proceedings of 2016 Antenna Applications Symposium, Robert Allerton Park, Illinois, 20-22 September, 2016.

\*\* reviewed by multiple referees

#### II.4. Media Coverage of Research

- *Folding Frontier: Origami Engineering Could Be the Next Big Thing in Manufacturing*, PRiSM (ASEE Magazine; cover story), Jan. 2013.
- *Academic Case Study: Using Abaqus to Simulate Self-folding Structures*, Simulia Community News, May 2015, pp. 13–14.
- *Better flight through shape-shifting materials*, Aerospace America, December 2015, pp. 6–7.

#### II.5. Funded Research Projects

Summary: From 2010 to present, individually and independently granted over \$1.96M from industrial and government sponsors.

Principle Investigator / Co-PI

1. “Modeling of SMA Actuated Trailing Edge Devices,” Boeing Company, PI: Lagoudas, Co-PI: Hartl, 10/1/09 – 9/30/2010, \$134,721, Hartl:\$134,721.
2. “Analysis of Shape Memory Alloy (SMA) Test Data and Characterization of SMA Test Specimens, Boeing Company, ” PI: Lagoudas, Co-PI: Hartl, Students: 1, 3/11/10 – 6/30/2010, \$35,000, Hartl:\$5,000.
3. “Large Tube and High Torque Test Bed (HTTB) Modeling Using ABAQUS and UMATs,” Boeing Company, PI: Lagoudas, Co-PI: Hartl, 3/26/10 – 9/30/10, \$38,650, Hartl:\$38,650.
4. “Texas A&M University eMAR Active Spar FEA Analysis,” Boeing Company, PI: Lagoudas, Co-PI: Hartl, 10/1/10 – 12/31/10, , \$19,477, Hartl: \$19,477.
5. “Improved SMA Actuators,” Boeing Company, PI: Lagoudas, Co-PI: Hartl, Students: 1, 2/7/11 – 10/30/11, , \$70,500, Hartl: \$70,500.
6. “Conformal Moldline Link (CML) Modeling Using ABAQUS,” Boeing Company, PI: Hartl, Co-PI: Lagoudas, Students: 1, 3/15/11 – 12/31/11, \$95,655, Hartl: \$95,655.
7. “Active Spar Finite Element Analysis Support,” Boeing Company, PI: Lagoudas, Co-PI: Hartl, 5/1/11 – 10/16/11, \$46,500, Hartl: \$46,500.
8. “Educational Institution Contract with Texas A&M University,” Sandia National Laboratories, PI: Lagoudas, Co-PIs: Boyd, Hartl, Karaman, Students: 2, 9/2/11 – 8/31/12, \$25,000, Hartl: \$5,000.
9. “Conformal Moldline Link (CML) Modeling Using ABAQUS (Follow-On),” Boeing Company, PI: Hartl, Students: 1, 2/15/12 – 8/14/12, \$51,693, Hartl: \$51,693.

10. "Improved SMA Modeling and Control Methods and Tools," Boeing Company, PI: Hartl, Students: 1, 2/15/12 – 6/15/12, \$29,404, Hartl: \$29,404.
11. "Implementation of SMAs into Aircraft Seating - Phase 1: Headrest," Weber Aircraft LLC, PI: Hartl, Co-PI: Lagoudas, Students: 1, 5/1/12 – 6/30/12, \$27,047, Hartl: \$27,047.
12. "Shape Memory Alloy Fatigue," Boeing Company, PI: Lagoudas, Co-PI: Hartl, Students: 1, 6/22/12 – 12/14/12, \$50,000, Hartl: \$5,000.
13. "Automated Morphing Wall Installation," TAMU Academy for the Visual and Performing Arts, PI: Esquivel, Co-PI: Hartl, 1/15/13 – 1/15/14, \$7,271, Hartl: \$3,500.
14. "Engineering Services for the Smart High-turndown Area Articulator with Passive Environment Response," Jacobs Technology Inc. / NASA-JSC, PI: Hartl, 06/01/13 – 06/30/13, \$11,500, Hartl:\$11,500.
15. "Improved SMA Modeling Methods and Tools," Boeing Company, PI: Hartl, 12/10/13 – 12/10/14, \$30,900, Hartl: \$30,900.
16. "Development of Analysis Tools for Induction Heating of SMAs," Boeing Company, PI: Hartl, Co-PI: Boyd, Students: 1, 02/01/14 – 05/31/14, \$31,400, Hartl: \$16,000.
17. "Coupling Damage-Sensing Particles and Computational Micromechanics to Enable the Digital Twin: Phase II," NASA, PI: Hochhalter, Co-PIs: Newman, Leser, Glassgen, Ratcliffe, Gupta, Heber, Hartl, Karaman, Students: 2, 4/1/2104–9/30/15, \$300,000, Hartl: \$50,000.
18. "Tensile and Torque Tube Fatigue Characterization of NiTiHf High Temperature Shape Memory Alloys," PI: Karaman, Co-PI: Hartl, Lagoudas, Students: 2, 6/1/14 – 12/31/14, \$65,000, Hartl: \$21,000.
19. "AFE 77 - Shape Memory Alloy Test Methods", Various Sponsors (via Aerospace Vehicle Systems Institute) PI: Hartl, Students: 1, 06/01/2014–10/31/2015, \$26,918, Hartl: \$26,918.
20. "Improved SMA Modeling Methods and Tools (Add-On)," Boeing Company, PI: Hartl, 6/1/13 – 8/31/14, \$20,000, Hartl: \$20,000.
21. "Variable Geometry Radiators Using Shape Memory Alloys", NASA PI: Hartl, Students: 1, 08/01/2014–07/31/2016, \$130,000, Hartl: \$130,000.
22. "Computational Analysis and Design of an SMA-Based Broadhead Blade," Slick Hunting Products, PI: Hartl, Students: 1, 10/15/2014–12/15/2014, \$5,500, Hartl: \$5,500.
23. "Analysis and Optimal Design of SMA-Enabled Reconfigurable Structures for Airframe Noise Control," NASA (via National Institute of Aerospace), PI: Hartl, Students: 1, 11/15/2014–12/31/2016, \$114,000, Hartl: \$114,000.
24. "Multi-Functional, Multi-Scale Design for Reconfigurable Flight Structures", AFRL/RQVC (via UTC, Inc.) PI: Hartl, Students: 0, 12/15/2014–04/30/2015, \$35,000, Hartl: \$35,000.
25. "Avian-Inspired Multifunctional Morphing Vehicles", AFOSR (via UMichigan) PI: Hartl, Students: 2, 06/01/2015–06/30/2018, \$600,000, Hartl: \$600,000.
26. "Exploration of Design Methods for Bio-Inspired Compliant Load-Bearing Mechanisms Based on Evolutionary Algorithms", AFRL/RQVC (via UTC, Inc.) PI: Hartl, Students: 0, 06/15/2015–10/30/2015, \$18,991, Hartl: \$18,991.
27. "Exploration of Design Methods for Bio-Inspired Compliant Load-Bearing Mechanisms Based on Evolutionary Algorithms", AFRL/RQVC (via UDRI) PI: Hartl, Students: 0, 12/01/2015–03/30/2017, \$72,000, Hartl: \$72,000.

28. “Shape-Morphing Adaptive Radiator Technology”, NASA-JSC PI: Hartl, Co-PI: Whitcomb, Students: 2, 01/01/2016–12/31/2016, \$76,700, Hartl: \$76,700.
29. “Superelastic SMAs,” NASA (via National Institute of Aerospace), PI: Hartl, Co-PI: Strganac, Students: 1, 09/01/2016–09/25/2017, \$98,607, Hartl: \$98,607.
30. “Materials and Processing of Composite and Hybrids for Additive Research and Multifunctional Structures,” AFRL/RXCC (via Universal Technology Cooperation), PI: Huff, Co-PI: Hartl, Students: 1, 09/01/2015–02/28/2017, \$117,646, Hartl: \$2,447.

#### Senior Personnel

- “EFRI-OSISSEI: Synthesizing Complex Structures from Programmable Self-Folding Active Materials,” NSF, PI: Malak, Co-PIs: Lagoudas, Amato, Akleman, McAdams \$1,998,423, 8/1/12 – 7/31/16 (Member of core proposal team; manage AERO component), Hartl: \$196,325.

### **II.6. New Design Methods, Patents**

1. “Shape Memory Alloy Rods for Actuation of a Continuous Moldline Link Technology,” C. Madsen (Boeing) and D. Hartl, Disclosure of Invention filed Jan. 2013.
2. “A Device for Variable Heat Rejection in a Vacuum Through the Passive Actuation of Radiator Panels in Response to Temperature,” T. Cognata (Paragon SDC), C. Dinsmore (NASA), and D. Hartl, Disclosure of Invention filed Jul. 2013.
3. “Variable Heat Rejection Device,” T. Cognata (Paragon SDC), C. Dinsmore (NASA), R. Sheth (NASA), and D. Hartl, Patent application 14960301 filed Dec. 2015.
4. “A flexible thermally conductive composite laminate panel for a radiative variable heat rejection device that uses the temperature dependent behavior of shape memory alloys to passively open/close the panel in response to the panels temperature,” C. Bertagne, J. McQuien, M. Wescott, D. Hartl, J. Whitcomb, Disclosure of Invention filed Oct. 2016.

## **III. Service**

### **III.1. Membership in Professional Societies**

American Institute of Aeronautics and Astronautics (AIAA) (1999)  
 International Society for Optics and Photonics (SPIE) (2007)  
 American Society of Mechanical Engineers (ASME) (2011)  
 The Minerals, Metals, and Materials Society (TMS) (2011)

### **III.2. Professional Societies Service and Leadership**

#### Service

- Active Member, ASME Aerospace Division, Adaptive Structures & Material Systems Branch, Sept. 2011 – present
- Active Member, ASME Branch on Adaptive Structures & Material Systems, Active and Multifunctional Materials Technical Committee, Sept. 2012 – present
- Active Member, AIAA Adaptive Structures Technical Committee, Jan. 2015 – present

#### Leadership

- Secretary, ASME Branch on Adaptive Structures & Material Systems, Active and Multifunctional Materials Technical Committee, Sept. 2012 – present
- Symposium 2 Co-Chair, ASME Branch on Adaptive Structures & Material Systems, Active and Multifunctional Materials Technical Committee, Mar. 2014 – present
- Secretary, ASME Aerospace Division, Adaptive Structures & Material Systems Branch, Sept. 2015 – Sept. 2016
- Treasurer, ASME Aerospace Division, Adaptive Structures & Material Systems Branch, Sept. 2016 – present

### **III.3. Conference/Symposium/Workshop Organization**

#### Conference Organizing Leadership

- Co-Chair: Student Paper Competition, SPIE Smart Structures/NDE Conference, Sept. 2013–present.
- Co-Chair: ASME, Smart Materials Adaptive Structures and Intelligent Systems Conference, Mechanics and Behavior of Active Materials Symposium, Mar. 2014–present.

#### Conference Organizing Committee

- SMI-FASE 2016 (Shape Modeling International’2016 - Fabrication and Sculpting Event), Jun. 20-24, 2013, Berlin.
- Gordon Research Conference on “Multifunctional Materials and Structures”, Social Committee, Jan 31–Feb 5, 2016, Ventura, CA.
- International Conferences on Modern Materials and Technologies, International Advisory Board, “Biomimetic Morphing of Unmanned Aerial Vehicles,” June 5-10, 2016, Perugia, Italy.
- Shape Modeling International (SMI/ISAMA: Shape Fabrication & Sculpting), Jul. 24-26, 2015, Telecom-Lille, France.
- SPIE Smart Structures/NDE Conference, Behavior and Mechanics of Multifunctional Materials and Composites IX (Conference 9432), Mar. 8–12, 2015, San Diego, CA.
- ASME, Smart Materials Adaptive Structures and Intelligent Systems Conference, Mechanics and Behavior of Active Materials Symposium, Sept. 16-18, 2013, Salt Lake City, UT.
- Shape Modeling International (SMI/ISAMA: Shape Fabrication & Sculpting), Jul. 10-12, 2013, Poole, UK.

#### Workshop Organizer

- Texas A&M SMA Research Summer Workshop, Aug. 4, 2011, College Station, TX.

### **III.4. Journal Service and Organization**

#### Journal Associate Editor

- Journal of Intelligent Material Systems and Structures

#### Journal Reviewer

AIAA Journal, ASME Journal of Mechanical Design, European Journal of Mechanics, International Journal of Plasticity, International Journal of Precision Engineering and Manufacturing, International Journal of Solids and Structures, Journal of Applied Mechanics,



Journal of Intelligent Material Systems and Structures, Journal of Mechanical Science and Technology, Smart Materials and Structures, and many others.

#### Special Issue Organization

- Co-Editor, Smart Materials Structures special issue on *Active Materials and Structures for Origami Engineering*, September 2014.
- Co-Editor, Smart Materials Structures special issue on *Adaptive and active materials: selected papers from the ASME 2014 Conference on Smart Materials, Adaptive Structures and Intelligent Systems (SMASIS 14) (Newport, RI, USA, 8–10 September 2014)*, September 2015.

## IV. Professional Outreach

### IV.1. Seminars and Presentations

#### Invited Talks and Seminars

1. *\*\*Constitutive Modeling and FEA Analysis of Shape Memory Alloy Materials and Applications*, Department of Mechanical Engineering and Aeronautics Seminar, The University of Patras, Patras, Greece, September 2009.
2. *Recent Advances in the Analysis, Design and Optimization of SMA-Based Aerostructures*, Aerospace Engineering Seminar Series, Texas A&M University, College Station, Texas, January 2011.
3. *Optimized Design of SMA-Based Active Structures*, Winter Meeting of the OSU/TAMU Smart Vehicle Concepts Center, College Station, Texas, February 2011.
4. *\*\*Recent Advances in the Analysis, Design and Optimization of SMA-Based Aerostructures*, COBEM 2011: 21st International Congress of Mechanical Engineering, Natal, Brazil, October 2011.
5. *Advanced Multi-physical Analysis and Optimization of SMA-Based Morphing Structures*, Workshop on “New Concepts for Active Materials, Actuators, and Bioinspired Sensing-Actuation Control” University of Washington, Seattle, Washington, April 2012.
6. *\*\*Advanced Multi-physical Analysis and Optimization of SMA-Based Morphing Structures*, Institute of Mechanics Seminar, Technical University Dortmund, Dortmund, Germany, June 2012.
7. *\*\*Advanced Multi-physical Analysis and Optimization of SMA-Based Morphing Structures*, Department of Mechatronics Seminar, University of Saarland, Saarland, Germany, June 2012.
8. *\*\*Advanced Multi-physical Analysis and Optimization of SMA-Based Morphing Structures*, Seminar of Laboratoire d’étude des Microstructures et de Mécanique des Matériaux (LEM<sup>3</sup>), Arts et Métiers ParisTech, Metz, France, July 2012.
9. *\*\*Advanced Multi-physical Analysis and Optimization of SMA-Based Morphing Structures*, Advanced Composites Centre for Innovation and Science, Bristol University, Bristol, UK, July 2012.
10. *\*\*Numerical Analysis and Design of Novel SMA-Based Systems*, Seminar of Laboratoire d’étude des Microstructures et de Mécanique des Matériaux (LEM<sup>3</sup>), Arts et Métiers ParisTech, Metz, France, May 2013.

11. *SYMP 2: Modeling, Design Optimization, and Experimental Assessment of SMA-Based Reconfigurable Structures*, ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Snowbird, UT, Sept. 2013.
12. *Modeling, Design Optimization, and Experimental Assessment of SMA-Based Reconfigurable Structures* Aerospace Engineering Seminar Series, Texas A&M University, College Station, Texas, August 2013.
13. *Materials Development and Analysis-Driven Design for Multifunctional Material Applications* NASA Langley Research Center, Hampton, VA, September 2013.
14. *Modeling, Design Optimization, and Experimental Assessment of SMA-Based Reconfigurable Structures* Boeing Research and Technology “SMA Research Summit”, The Boeing Company, Seattle, Washington, January 2014.
15. *Modeling and Analysis of Recoverable and Irrecoverable Inelastic Phenomena in Phase Transforming Structural Materials Across Scales* Aerospace Engineering Seminar Series, Texas A&M University, College Station, Texas, February 2014.
16. *Modeling and Analysis of Recoverable and Irrecoverable Inelastic Phenomena in Shape Memory Alloys Across Scales* Mechanical Engineering Seminar, Virginia Tech, Blacksburg, Virginia, March 2014.
17. *Modeling, Optimization, and Characterization of SMA-Based Reconfigurable Structures* Army Research Lab, Adelphi Laboratory Center, Adelphi, Maryland, April 2014.
18. *Modeling, Optimization, and Characterization of SMA-Based Reconfigurable Structures* US Naval Research Lab, Multifunctional Materials Branch, Washington, D.C., April 2014.
19. *Analysis and Design of Functionally Optimized SMA-Based Reconfigurable Structures* Air Force Research Lab, Structural Materials Division, Materials and Manufacturing Directorate, Dayton, OH, May 2014.
20. *\*\*Methods for Analysis and Optimization of SMA-Based Structures Across Scales*, 3rd Annual Symposium on Smart and Multi-functional Materials, Center for Smart Materials and Structures, Harbin Institute of Technology, Harbin, China, June 2014.
21. *Analysis and Design of Functionally Optimized SMA-Based Reconfigurable Structures*, Dept. of Mechanical Engineering William Maxwell Reed Seminar Series, University of Kentucky, Lexington, KY, October 2015.
22. *Multiphysical Modeling and Design of Multifunctional Aerostructures Across Scales*, Dept. of Aerospace Engineering Seminar Series, University of Michigan, Ann Arbor, MI, January 2016.
23. *Additive Topological Optimization of Muscular-Skeletal (Micro?) Structures via Genetic Programming*, Air Force Research Lab, Structural Materials Division, Materials and Manufacturing Directorate, Dayton, OH, March 2016.
24. *Multifunctional Composites and Genetic Programming for Adaptive Structures Design: An Air Force Research Laboratory Experience* Aerospace Engineering Seminar Series, Texas A&M University, College Station, Texas, April 2016.

\*\* International

#### Panels

1. *SYMP I: Origami IV – Panel*, ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Snowbird, UT, Sept. 2013.

Presentations at Professional Meetings (Personally Presented)

1. *Thermomechanical Characterization and Modeling of Ni60Ti40 SMA for Actuated Chevrons*. IMECE 2006 Conference, Chicago, Nov. 2006
2. *Characterization and 3-D Modeling of Ni60Ti SMA for Actuation of a Variable Geometry Jet Engine Chevron*. SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2007
3. *3-D FEA Modeling of Ni60Ti40 SMA Beams as Incorporated in Active Chevrons*. ASME Applied Mechanics and Materials Conference, Austin, TX. June 2007.
4. *Experimental Investigation and Modeling of Plastic Deformation in Shape Memory Alloys*. Society of Engineering Science National Conference, College Station, TX. October 2007.
5. *Experimentally Validated Numerical Analysis of Aerostructures Incorporating Shape Memory Alloys*. Society of Engineering Science National Conference, College Station, TX. October 2007.
6. *Simultaneous Transformation and Plastic Deformation in Shape Memory Alloys*. SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2008.
7. *Experimentally Validated Numerical Analysis of Aerostructures Incorporating Shape Memory Alloys*. SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2008.
8. *Numerically Implemented Constitutive Model for SMA: Plastic Deformation and Large Rotations*. ASME 2008 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, Ellicott City, MD. October 2008.
9. *Three-Dimensional Modeling of Rate-Independent and Rate-Dependent Irrecoverable Deformation in Shape Memory Alloys*. SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2009.
10. *Modeling of Shape Memory Alloy Materials and Structures*. CASMART Summer Meeting, Cleveland, Ohio, Jun. 2009.
11. *ESF EUROCORES S3T ModelingData Set: TAMU Results*. 8th European Symposium on Martensitic Transformations (ESOMAT), Prague, CR, September 2009.
12. *Creep Behavior in TiPdNi High Temperature Shape Memory Alloy*. 8th European Symposium on Martensitic Transformations (ESOMAT), Prague, CR, September 2009.
13. *Three-Dimensional Modeling of Rate-Dependent Deformation in Shape Memory Alloys at High Temperatures*. SMASIS 2009 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, Oxnard, California, September 2009.
14. *3-D Finite Element Analysis of Indentation Recovery due to the Shape Memory Effect* SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2010.
15. *Characterization of Varied Geometry Shape Memory Alloy Beams* SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2010.
16. *Analysis of Shape Memory Alloy Components Using Beam, Shell, and Continuum Finite Elements*. SMASIS 2010 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, Philadelphia, Pennsylvania, September–October 2010.
17. *Modeling and Experimental Study of Simultaneous Creep, Plasticity and Transformation in High Temperature Shape Memory Alloys During Cyclic Actuation* TMS 2011 Annual Meeting and Exhibition, San Diego, February–March 2011.

18. *Analysis and Optimization of Improved Hybrid SMA Flexures for High Rate Actuation* SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2011.
19. *Design Optimization of a Shape Memory Alloy Actuated Morphing Aerostructure*, SMASIS 2011 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, Scottsdale, Arizona, September 2011.
20. *Phenomenological Modeling of Induced Transformation Anisotropy in Shape Memory Alloy Actuators*, SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2012.
21. *Thermal and Mechanical Modeling of a Conceptual Shape Memory Alloy Rotary Actuator for Aerospace Applications*, SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2012.
22. *Ni-Rich Shape Memory Alloy Fatigue Testing and Modeling*, Summer Meeting of the OSU/TAMU Smart Vehicle Concepts Center, Columbus, Ohio, July 2012.
23. *A Study of Actuation Fatigue of Shape Memory Alloy*, SMASIS 2012 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, Stone Mountain, Georgia, September 2012.
24. *Characterization and Modeling of Trained NiTiInol Torsional Actuators Under Reverse Bias Loads*, SMASIS 2012 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, Stone Mountain, Georgia, September 2012.
25. *Comparison of Three-Dimensional SMA Models: Finite Element Analysis of Common Engineering Components*, SMASIS 2012 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, Stone Mountain, Georgia, September 2012.
26. *Computational Design of a Reconfigurable Origami Space Structure Incorporating Shape Memory Alloy Thin Films*, SMASIS 2012 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, Stone Mountain, Georgia, September 2012.
27. *Design of a Massively Reconfigurable Origami Space Structure Incorporating Shape Memory Alloys*, IMECE 2012, ASME 2012 International Mechanical Engineering Congress and Exposition, Houston, Texas, November 2012.
28. *Anisotropic Phase Transformation and Plastic Yield in Polycrystalline SMAs*, IMECE 2012, ASME 2012 International Mechanical Engineering Congress and Exposition, Houston, Texas, November 2012.
29. *Modeling Shape Memory Alloy Single Crystalline Responses Using an Anisotropic Yield Surface*, TMS 2013 142nd Annual Meeting and Exhibition, San Antonio, Texas, March 2013.
30. *Thermomechanical Modeling of Shape Memory Alloys and Associated Application Analysis and Design*, AeroMat 2013 Conference and Exposition, Bellevue, WA, April 2013.
31. *"Pop-Op:" A Kinetic Surface*, Shape Modeling International 2013 (SMI'13), Bournemouth, UK, July 2013.
32. *Towards Building Smart Self-Folding Structures*, Shape Modeling International 2013 (SMI'13), Bournemouth, UK, July 2013.
33. *Shape Memory Alloy Laminate for Design of Self-Folding Reconfigurable Structures* 19th International Conference on Composite Materials, Montreal, July-August 2013.
34. *Analysis-driven Design Optimization of a SMA-based Slat-cove Filler for Aeroacoustic Noise Reduction* ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Snowbird, UT, Sept. 2013.

35. *Experimental Validation of a Shape Memory Alloy Constitutive Model by Heterogeneous Thermal Loading Using Infrared Thermography and Digital Image Correlation* ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Snowbird, UT, Sept. 2013.
36. *Fabrication of Shape Memory Alloy Based Self-folding Sheets* ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Snowbird, UT, Sept. 2013.
37. *Connectivity of Shape Memory Alloy-based Self-folding Structures* AIAA SciTech, National Harbor, MD, January 2014.
38. *Iterative Calibration of an SMA Constitutive Model from 1-D and 2-D Data Using Optimization Methods*, SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2014.
39. *Three-Dimensional Constitutive Model Considering Transformation-Induced Damage and Resulting Fatigue Failure in SMAs*, SPIE Smart Structures and Materials/NDE Conference, San Diego, March 2014.
40. *Efficient Analysis of Shape Memory Alloy Single Crystalline and Textured Polycrystalline Responses Via Anisotropic Yield Surfaces*, International Conference on Shape Memory and Superelastic Technologies (SMST), Pacific Grove, CA, May 2014.
41. *Development and Analysis-Driven Design Optimization of an SMA-Based Slat-Cove Filler for Airframe Noise Reduction in Transport Aircraft*, International Conference on Shape Memory and Superelastic Technologies (SMST), Pacific Grove, CA, May 2014.
42. *Self-Folding of Reconfigurable Structures Using Programmable Active Laminates*, 6th International Meeting on Origami in Science, Mathematics and Education, Tokyo, Aug. 10–13, 2014.
43. *Rectilinear Locomotion Using a Miura-Ori Fold Pattern*, 6th International Meeting on Origami in Science, Mathematics and Education, Tokyo, Aug. 10–13, 2014.
44. *Aero-structural Optimization of Shape Memory Alloy-based Wing Morphing via a Class/Shape Transformation Approach*, AIAA SciTech 2015, Kissimmee, FL, January 2015.
45. *A Morphing Radiator for High-Turndown Thermal Control of Crewed Space Exploration Vehicles*, AIAA SciTech 2015, Kissimmee, FL, January 2015.
46. *Design of a Shape Memory Alloy Self-Expanding Stent via Open Source Optimization Methods*, International Conference on Shape Memory and Superelastic Technologies (SMST), Chipping Norton, UK, May 2015.
47. *Analysis and Design of Shape Memory Alloy Morphing Radiators*, International Conference on Shape Memory and Superelastic Technologies (SMST), Chipping Norton, UK, May 2015.
48. *Parameterized Optimization of MHD-Driven Microvascular Cooling System for Structurally Integrated Electronics*, ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Colorado Spring, CO, Sept. 21–23, 2015.
49. *Design of Muscular-Skeletal Tensegrity-Like Structures via a Genetic Programming Approach*, Society of Engineering Science 2015 Meeting, College Station, TX, Oct. 26–28, 2015.
50. *Modeling Shape Memory Alloys Crystalline Transformation Responses Using an Anisotropic Yield Surface*, Society of Engineering Science 2015 Meeting, College Station, TX, Oct. 26–28, 2015.

51. *Additive Topological Optimization of Muscular-Skeletal Structures via Genetic L-System Programming*, AIAA SciTech 2016, San Diego, CA, Jan. 4–8, 2016.
52. *Experimental Validation of an Analysis Framework for Morphing Radiators*, SPIE Smart Structures and Materials/NDE Conference, Las Vegas, March 2016.
53. *Analysis and Characterization of Structurally Embedded Vascular Antennas Using Liquid Metals*, SPIE Smart Structures and Materials/NDE Conference, Las Vegas, March 2016.
54. *High Bandwidth Distributed Actuation of SMAs through Inductive Heating and Cooling of Liquid Metal Channels*, ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Stowe, VT, Sept. 28–30, 2016.
55. *Design, Fabrication, and Testing of a Composite Morphing Radiator*, ASME Smart Materials Adaptive Structures and Intelligent Systems (SMASIS) Conference, Stowe, VT, Sept. 28–30, 2016.