

Gregory D. Buckner
Professor, Department of Mechanical and Aerospace Engineering
North Carolina State University
Raleigh, NC 27695-7910
<http://www.mae.ncsu.edu/faculty-staff/profile/gregory-buckner/>

A. Professional Preparation

University of Texas at Austin	Mechanical Engineering	Ph.D.	1996
Virginia Polytechnic Institute	Mechanical Engineering	M.S.	1987
Louisiana State University	Mechanical Engineering	B.S.	1986

B. Appointments

2010-present	Professor, Mechanical & Aerospace Engineering, NC State University
2004-present	Affiliate Faculty, Biomedical Engineering, UNC-Chapel Hill and NC State University
2004-2010	Associate Professor, Mechanical & Aerospace Engineering, NC State University
1999-2004	Assistant Professor, Mechanical & Aerospace Engineering, NC State University
1997-1999	Research Engineer, University of Texas at Austin Center for Electromechanics
1996-1997	Process Controls Consultant, Austin TX
1991-1996	Graduate Research Assistant, University of Texas at Austin
1988-1991	Senior Engineer, Westvaco's Covington Research Center

C. Research and Teaching Interests

Modeling, fabrication and control of dynamic systems, electromechanical systems, intelligent control systems, mechatronics, surgical robotics

D. Scientific and Professional Societies

Pi Tau Sigma: Mechanical Engineering Honor Society (Faculty Advisor, NCSU Chapter), Tau Beta Pi: Engineering Honor Society, Phi Kappa Phi: Academic Honor Society, Sigma Xi: Scientific Research Honor Society, American Society of Mechanical Engineers (ASME), Institute of Electrical and Electronics Engineers (IEEE), American Society for Engineering Education (ASEE)

E. Scholarly and Professional Honors

Board of Governors Award for Excellence in Teaching, North Carolina State University College of Engineering Recipient, 2013.

Carnot Award for Teaching Excellence, North Carolina State University chapter of the American Society of Mechanical Engineers: 2012, 2011, 2010, 2008, 2004, 2000

Faculty Impact Award, North Carolina State University chapter of the American Society of Mechanical Engineers: 2012, 2005

Distinguished Undergraduate Professor Award, North Carolina State University Alumni Association, 2007

Ralph R. Teetor Educational Award, The Society of Automotive Engineers (SAE International), 2006

New Faculty Research Award, American Society of Engineering Education, Southeast Region, 2002

Outstanding Teacher Award, induction into the Academy of Outstanding Teachers, North Carolina State University, May 2002

NSF CAREER Award - "Intelligent Control Systems for Active Magnetic Bearings: An Enabling Technology for Flywheel Energy Storage Systems", January 2001

F. Professional Society Memberships

Pi Tau Sigma - Mechanical Engineering Honor Society

Tau Beta Pi - Engineering Honor Society

Phi Kappa Phi - Academic Honor Society

American Society of Mechanical Engineers (ASME)

American Society for Engineering Education (ASEE)

G. Consulting Activities

2007-Present: Physcient, Inc. (Raleigh, NC) - Technical advising to startup company developing instrumented retractors for cardiothoracic surgery

1996-2008: Mead-Westvaco Corporation, (Charleston, SC, Luke, MD, Covington, VA, Wickliffe, KY and Santa Caterina, Brazil) - Evaluating, tuning, and upgrading Acoustic Leak Detection Systems (ALDS) to detect hazardous steam leaks in black liquor recovery boilers

1999-2002: University of Texas Center for Electromechanics (UT-CEM), Austin, TX - Developed and implemented intelligent system identification and control algorithms for UT-CEM's active vehicle suspension program, real-time tests conducted on a military HMMWV at the U.S. Army's Yuma Proving Grounds, Yuma, NM

1994-2000: Co-Founder, Partner: Compu-Crane, Inc., Raleigh NC - developed a Windows software application, Crane Selection and Planning Software (CSPS), to select cranes for critical lifts and graphically simulate project; distributed with every new Grove and Manitowoc crane; named Lifting & Transportation's most requested product of 1995

H. Collaborators and Advisorships

Dr. Gil Bolotin (Cardiac Surgery, Academic Hospital of Maastricht, Netherlands), Dr. Guillaume Chanoit (Veterinary Medicine, NCSU), Dr. Randolph Chitwood (Cardiac Surgery, Brody School of Medicine, ECU), Dr. Richard Cook (Cardiac Surgery, University of British Columbia, Canada), Dr. Denis Cormier (Industrial & Systems Engineering, NCSU), Dr. Angus Kingon (Materials Science & Engineering, NCSU), Dr. Bryan Laffitte (Industrial Design, NCSU), Dr. Tiegang Fang (Mechanical & Aerospace Engineering, NCSU), Dr. Andor Van Den Hoven (Radiology and Nuclear Medicine, University Medical Center Utrecht, the Netherlands), Dr. Daniel Von Allmen (Pediatric Surgery, UNC)

Thesis Advisorships (39) and Postgraduate-Scholar Sponsorships (4)

Dr. Kari Tammi (Post-Doc, MAE, 2008), Dr. Bei Lu (Post-Doc, MAE, 2005), Dr. Soheil Saadat (Post-Doc, MAE, 2004), Prof. Byeong-Mook Chung (Visiting Scholar, MAE, 2006), Jeff Allred (PhD, MAE, current), Eric Boros (PhD, MAE, current), Chris Elliott (PhD, MAE, current), Brent Kitchen (PhD, MAE, current), Bongani

Malinga (PhD, MAE, current), Andrew Richards (PhD, MAE, 2013), Jennifer Hannen Wiest (PhD, MAE, 2013), John Crews (PhD, MAE, 2011), J.P. Lien (PhD, MAE, 2011), Arun Veeramani (PhD, MAE, 2009), Molly Purser (PhD, ISE, 2009), Omar Zohni (PhD, MAE, 2008), Pradeep Pandurangan (PhD, MAE, 2007), Heeju Choi (PhD, MAE, 2005), Nathan Gibson (PhD, MAE, 2004), Soheil Saadat (PhD, MAE, 2003), Brad Lawrence (PhD, IE, 2002), John Archer (MS, MAE, 2013), Casey Haigh (MS, MAE, 2013), Michael Mattson (MS, MAE, 2010), Nana Noel (MS, MAE, 2008), Jay Robb (MS, MAE, 2008), Andrew Richards (MS, BME, 2008), Paul Bachmeyer (MS, MAE, 2008), Sean Dugan (MS, MAE, 2007), Neil Milani (MS, MAE, 2006), Shaphan Jernigan (MS, MAE, 2006), Aaron Kiefer (MS, MAE, 2004), Jonathan Kuniholm (MS, MAE, 2003), Mike Blue (MS, MAE, 2003), David Hood (MS, MAE, 2003), Michael Craft (MS, MAE, 2003), Jason Stevens (MS, MAE, 2002), F. Donald Caulfield (MS, MAE, 2002), Ravindra Dixit (MS, MAE, 2001), Vignesh Jayanth (MS, MAE, 2001)

I. Synergistic Activities

Innovative Tools and Techniques for Robot Assisted Cardiac Surgery (NIH, 2004-2007) – PI of large scale, multi-university concurrent design project to develop endoscopic tools for minimally-invasive cardiac surgery; with professors Cormier (Industrial & Systems Engr.) and Laffitte (College of Design) at NCSU, surgeons Chitwood and Nifong of ECU, surgeon Bolotin of Academic Hospital Maastricht, surgeon Cook of Univ. of British Columbia

Faculty Affiliate, Institute for Maintenance Science and Technology (NCSU, 2008-2010) – DOD and affiliate-funded research with faculty and graduate students from Materials Science and Engineering, Industrial and Systems Engineering, MAE and other departments

J. Entrepreneurial Activities

Founder and CEO, emTECH LLC, Raleigh NC, 2012-Present

Chief Science Officer, Physcient Inc., Durham NC, 2007-Present

Co-founder, Compu-Crane Inc., Graham NC, 1994-2003

K. Patents and Licensing Agreements

1. Gregory D. Buckner, Gil Bolotin: Force-determining retraction device and associated method. North Carolina State University, August 2010: US 07775974.
2. Jerry Lee Wordsworth, Jerry Barnes, Gregory D. Buckner: Intelligent power management system. October 2012: US 08295950.
3. Gregory D. Buckner, Tiegang Fang: Fuel injection device for an internal combustion engine, and associated method. North Carolina State University, January 2011: US 20110005499-A1.
4. Gregory D. Buckner, Arun Shankar Veeramani, Stephen B. Owen, Shaphan R. Jernigan: Active Catheter Device and Associated System and Method. North Carolina State University, October 2012: WO/2012/135339.
5. Acutus Medical: exclusive license agreement for Active Catheter Device and Associated System and Method, via NCSU's Office of Technology Transfer, 2012.
6. PhyScient, Inc.: exclusive license agreement for Force-determining retraction device and associated method, 2007.

L. Doctoral Advising

1. Andrew L. Richards (PhD/MAE), "Experimental Investigations into the Targeted Delivery of Microspheres in Radioembolization Therapy", funded by Sirtex Medical, Inc., defended 08/30/13.
2. Jennifer H. Wiest (PhD/MAE), "Nonlinear Control Strategies for a Teleoperated Cardiac Ablation Catheter Actuated by Shape Memory Alloy Tendons: System Modeling, Controller Synthesis, and Experimental Validation", funded by the NIH (NHLBI), defended 03/28/13.
3. John P. Lien (PhD/MAE), "Design, Modeling, and Control of a Variable Geometry Spray Fuel Injector", funded by the NSF (CBET), defended 08/10/11.
4. John Crews (PhD/MAE), "Development of a Shape Memory Alloy Actuated Robotic Catheter for Endocardial Ablation: Modeling, Design Optimization, and Control", funded by the NIH (NHLBI), defended 01/14/11.
5. Arun Veeramani (PhD/MAE), "Design, Modeling and Control of Shape Memory Alloy Actuated Robotic Catheter", funded by the NIH (NHLBI), defended 03/26/09.
6. Molly Purser (PhD/ISE, co-supervised with Denis R. Cormier), "Development and Surgical Evaluation of a Novel Annuloplasty Ring with a Shape Memory Alloy Core", funded by the NIH (NHLBI), defended 03/23/09.
7. Omar Zohni (PhD/MAE), "Design, Fabrication and Experimental Characterization of PZT Membranes for Passive Low Frequency Vibration Sensing", funded by the DOE (NNP Fellowship), defended 12/04/08.
8. Pradeep Pandurangan (PhD/MAE), "Real-Time Structural Health Monitoring for Aerospace Structures", funded by Goodrich, defended 12/08/06.
9. Heeju Choi (PhD/MAE), "Intelligent Control using Confidence Interval Networks: Applications to Robust Control of Active Magnetic Bearings", funded by the NSF (ENG/ECCS), defended 3/28/05.
10. Nathan Gibson (PhD/MAE), " H_∞ Control of Active Magnetic Bearings: An Intelligent Uncertainty Modeling Approach", funded by the NSF (ENG/ECCS), defended 9/10/04.
11. Soheil Saadat (PhD/MAE, co-directed with Dr. Mohammad Noori), "Structural Health Monitoring and Detection of Progressive and Existing Damage using Artificial Neural Networks-Based System Identification", funded by the NIA, defended 2/25/03.
12. Brad Lawrence (PhD/ISE, co-directed with Dr. Gary Mirka), "Intelligent System Identification Applied to the Biomechanical Response of the Human Trunk during Sudden Loading", defended 10/29/02.

M. Masters (Thesis Option) Advising

1. Casey Haigh (MS/MAE), "Modeling, Optimization and Experimental Validation of Shape Memory Alloy Bending Actuators", funded by the NIH (NHLBI), defended 06/17/13.

2. John R. Archer (MS/MAE), "Multi-objective Design Optimization of a Variable Geometry Spray Fuel Injector", funded by the NSF (CBET), defended 01/23/13.
3. Michael Mattson (MS/MAE), "Multi-objective Optimization of Semi-active Vehicle Suspension Control", funded by Lord Corporation, defended 06/30/10.
4. Nana Noel (MS/MAE), "GE-F110 Agile Combat Support – Intelligent Event Detection", funded by GE Aviation, defended 04/25/08.
5. Andrew Richards (MST/BME), "A dynamically pressurized heart model to facilitate the development of surgical tools and techniques for mitral valve repair", funded by the NIH (NHLBI), defended 02/15/08.
6. Jay Robb (MS/MAE), "Design and Simulation of an Active Load Balancing System for High-Speed, Magnetically Supported Rotors", employed by Ingersoll-Rand, defended 02/15/08.
7. Paul Bachmeyer (MS/MAE), "Simulation-Based Design Strategies for Component Optimization in Steer-by-Wire Applications", employed by Lord Corporation, defended 01/04/08.
8. Sean Dugan (MS/MAE), "On the Design, Modeling, and Control of an Electromechanical Pump System for Ex Vivo Testing of Surgically Repaired Mitral Valves", defended 09/12/07.
9. Neil Milani (MS/MAE), "Performance Design of a Wind-Turbine Diesel Microgrid Hybrid Power System" (co-advised with Dr. Jim Leach), defended 06/20/06.
10. Shaphan Jernigan (MS/MAE), "Finite Element Modeling of the Left Atrium to Facilitate the Design of an Endoscopic Atrial Retractor", funded by the NIH (NHLBI), defended 02/01/06.
11. Aaron Kiefer (MS/MAE), "Integrating Electromechanical Actuator Hardware with Receptance Coupling Substructure Analysis for Chatter Prediction on High Speed Machining Centers", funded by VulcanCraft, defended 3/25/04.
12. Jonathan Kuniholm (MS/MAE), "Automated Knot Tying for Fixation in Minimally Invasive, Robot Assisted Cardiac Surgery", defended 6/23/03.
13. Mike Blue (MS/MAE), "Development of a Non-Contacting Capacitive Displacement Sensor for Integrated Chatter Prediction on High Speed Milling Centers", funded by VulcanCraft, defended 5/20/03.
14. (n) David Hood (MS/MAE), "Force Feedback Control of Tool Deflection in Miniature Ball End Milling", funded by the NSF (ENG/DMII), defended 5/15/03.
15. Michael Craft (MS/MAE), "Design Optimization of MagneShock™ MR Dampers and Development of Fuzzy Logic Control for Semi-Active Vehicle Suspensions", funded by Carrera, defended 3/25/03.
16. Jason Stevens (MS/MAE), "Actuation and Control Strategies for Miniature Surgical Robotic Systems", funded by Johnson & Johnson (Ethicon), defended 7/08/02.

17. F. Donald Caulfield (MS/MAE), "Electromechanical Actuator Development for Integrated Chatter Prediction on High-Speed Machining Centers", funded by VulcanCraft, defended 3/29/02.
18. Ravindra Dixit (MS/MAE), "Sliding Mode Observation and Control for Semi-Active Vehicle Suspensions", defended 11/05/01.
19. Vignesh Jayanth (MS/MAE), "System identification and control of a magnetically-levitated flexible structure", defended 9/19/01.

N. Peer-Reviewed Journal Publications

1. AL Richards, AS Kennedy, GD Buckner, "Physical classification of resin-based Y-90 radioembolization microspheres", Journal of Experimental and Clinical Cancer Research
2. SR Jernigan, JA Osborne, CJ Mirek, GD Buckner, "Selective Internal Radiation Therapy: Quantifying Distal Penetration and Distribution of Resin and Glass Microspheres in a Surrogate Arterial Model", in review, Journal of Vascular and Interventional Radiology, 2014.
3. B Malinga, GD Buckner, "L1 Adaptive Control of a Shape Memory Alloy Actuated Flexible Beam", IEEE Transactions on Control System Technology
4. CJ Allred, MA Jolly, GD Buckner, "Determination of helicopter rotor blade motion through displacement of integrated parallel mechanism", Aerospace Science & Technology
5. J.R. Archer, T.G. Fang, S.M. Ferguson, G.D. Buckner, "Multi-objective Design Optimization of a Variable Geometry Spray Fuel Injector", Journal of Mechanical Design, 136(4), 2014.
6. H. Crews, R.C. Smith, K.M. Pender, J.C. Hannen, G.D. Buckner, "Data-driven techniques to estimate parameters in the homogenized energy model for shape memory alloys", Journal of Intelligent Material Systems and Structures, 23(17), 1897-1920, 2012.
7. J.C. Hannen, J. H. Crews, G.D. Buckner, "Indirect intelligent sliding mode control of a shape memory alloy actuated flexible beam using hysteretic recurrent neural networks", Smart Materials & Structures, 21(8), 2012.
8. A.L. Richards, M.D. Dickey, G.D. Buckner, "Design and demonstration of a novel micro-Coulter counter utilizing liquid metal electrodes", Journal of Micromechanics and Microengineering, 22 115012, 2012.
9. J.H. Crews, G.D. Buckner, "Design optimization of a shape memory alloy-actuated robotic catheter", Journal of Intelligent Material Systems & Structures, 23(5), 545-562, 2012.
10. A.L. Richards, C. Kleinstreuer, C. A.S. Kennedy, E. Childress, G.D. Buckner, "Experimental microsphere targeting in a representative hepatic artery system", IEEE Trans Biomed Eng. 59(1):198-204, 2012 (PMID: 21965193).
11. J.H. Crews, M.G. Mattson, G.D. Buckner, "Multi-objective Control Optimization for Semi-active Vehicle Suspensions", Journal of Sound and Vibration, ISSN 0022-460X, DOI: 10.1016/j.jsv.2011.05.036.
12. J.P. Lien, T. Fang, and G.D. Buckner, "Hysteretic neural network modeling of spring-coupled piezoelectric actuators", Smart Materials and Structures, 20(6): 065007:1-9, 2011.

13. J.P. Lien, A. York, T. Fang, G.D. Buckner, "Modeling piezoelectric actuators with Hysteretic Recurrent Neural Networks", *Sensors and Actuators A: Physical*, 163(2):516-525, 2010.
14. S.R. Jernigan, G.P. Chanoit, A.S. Veeramani, S.B. Owen, M.S. Hilliard, D.R. Cormier, B.W. Laffitte, G.D. Buckner, "A Laparoscopic Knot-Tying Device for Minimally Invasive Cardiac Surgery", *European Journal of Cardio-Thoracic Surgery*, 37:626-630, 2010 (PMID: 19854658).
15. B.M. Chung, Y.K. Lim, G.D. Buckner, "A tuning method for PID gains using Jacobian signs in multivariable control systems", *International Journal of Control, Automation, and Systems*, 7(5): 737-744, 2009.
16. M.F. Purser, A.L. Richards, R.C. Cook MD, J.A. Osborne, D.R. Cormier, G.D. Buckner, "Evaluation of a Shape Memory Alloy Reinforced Annuloplasty Band for Robot-Assisted Mitral Valve Repair", *Annals of Thoracic Surgery*: 88(4):1312-1316, 2009 (PMID: 19766827).
17. A.S. Veeramani, J.H. Crews, and G.D. Buckner, "Hysteretic Recurrent Neural Networks: A Modeling Tool for Hysteretic Materials and Systems", *Smart Materials and Structures*, 18:075004, 2009.
18. A.L. Richards, R.C. Cook, G. Bolotin, G.D. Buckner, "A dynamic heart system to facilitate the development of mitral valve repair techniques", *Annals of Biomedical Engineering*: 37(4):651-660, 2009 (PMID: 19224369).
19. S.R. Jernigan, Y. Fahmy, G.D. Buckner, "Implementing a Remote Laboratory Experience into a Joint Engineering Degree Program: Aerodynamic Levitation of a Beach Ball", *IEEE Transactions on Education*: 52(2): 205-213, 2009.
20. Bean, G. Chanoit, S. Jernigan, G. Bolotin, J. Osborne, G. Buckner, "Evaluation of a novel atrial retractor for exposure of the mitral valve in a porcine model", *Journal of Thoracic and Cardiovascular Surgery*, 136:1492-1495, 2008 (PMID: 19114196).
21. O. Zohni, G. Buckner, T. Kim, A. Kingon, R. Siergiej, "Effects of adhesion layers on the ferroelectric properties of PZT thin films deposited on silicon nitride substrates", *Thin Solid Films*, 516(18):6052-6057, 2008.
22. B. Lu, H. Choi, G. Buckner, K. Tammi "Linear Parameter-Varying Techniques for Control of A Magnetic Bearing System", *Control Engineering Practice*, 16(10):1161-1172, 2008.
23. A.S. Veeramani, G.D. Buckner, S.B. Owen, R.C. Cook, G. Bolotin, "Modeling the dynamic behavior of a shape memory alloy actuated catheter", *Smart Materials and Structures*, 17(1):1-14, 2008.
24. S.R. Jernigan, G.D. Buckner, J.W. Eischen, and D.R. Cormier, "Finite element modeling of the left atrium to facilitate the design of an endoscopic atrial retractor", *ASME Journal of Biomechanical Engineering*, 129(6):825-37, 2007 (PMID: 18067386).
25. G. Bolotin, G.D. Buckner, N.B. Campbell, M. Kocherginsky, J. Raman, V. Jeevanandam, J.G. Maessen, "Tissue-disruptive forces during median sternotomy", *Heart Surgery Forum*, 10(6):487-92, 2007 (PMID: 18187385).
26. S.A. Saadat, G.D. Buckner, and M.N. Noori, "Structural System Identification and Damage Detection using the Intelligent Parameter Varying Technique: An Experimental Study", *Structural Health Monitoring*, 6(3):231-243, 2007.

27. P. Pandurangan and G.D. Buckner, "Defect identification in GRID-LOCK® joints", *NDT & E International*, 40(5):347-356, 2007.
28. G. Bolotin, G.D. Buckner, N.J. Jardine, A.J. Kiefer, N.B. Campbell, M. Kocherginsky, J. Raman, and V. Jeevanandam, "A novel instrumented retractor to monitor tissue-disruptive forces during lateral thoracotomy", *Journal of Thoracic and Cardiovascular Surgery*, 133(4):949-54, 2007 (PMID: 17382632).
29. P. Pandurangan and G.D. Buckner, "Assessment of damage detection methods in GRID-LOCK® structures", *Mechanical Systems and Signal Processing*, 21(5):2185-2197, 2007.
30. O. Zohni, G. Buckner, T. Kim, A. Kingon, J. Maranchi and R. Siergiej, "Investigating thin film stresses in stacked silicon dioxide/silicon nitride structures and quantifying their effects on frequency response", *Journal of Micromechanics and Microengineering*, 17(5):1042-1051, 2007.
31. G.D. Buckner, H. Choi, and N.S. Gibson, "Estimating Model Uncertainty using Confidence Interval Networks: Applications to Robust Control", *ASME Journal of Dynamic Systems, Measurement, and Control*, 128(3):626-635, 2006.
32. P.S. Pandurangan and G.D. Buckner, "Vibration analysis for damage detection in metal-to-metal adhesive joints", *Experimental Mechanics*, 46(5):601-607, 2006.
33. B. Lawrence, G. Buckner, and G. Mirka, "An Adaptive System Identification Model of the Biomechanical Response of the Human Trunk During Sudden Loading", *ASME Journal of Biomechanical Engineering*, 128(2):235-241, 2006 (PMID: 16524336).
34. J.M. Stevens and G.D. Buckner, "Actuation and Control Strategies for Miniature Robotic Surgical Systems", *ASME Journal of Dynamic Systems, Measurement, and Control*, 127(4):537-549, 2005.
35. Kuniholm, G. Buckner, W. Nifong, and M. Orrico, "Automated Knot Tying for Fixation in Minimally Invasive, Robot Assisted Cardiac Surgery", *ASME Journal of Biomechanical Engineering*, 127(6):1001-1008, 2005 (PMID: 16438240).
36. B. Lawrence, G. Mirka, and G. Buckner, "Adaptive System Identification Applied to the Biomechanical Response of the Human Trunk during Sudden Loading", *Journal of Biomechanics*, 38(12):2472-2479, 2005 (PMID: 16214495).
37. R.K. Dixit and G.D. Buckner, "Sliding Mode Control and Observation for Semiactive Vehicle Suspensions", *Vehicle System Dynamics*, 43(2):83-105, 2005.
38. S.A. Saadat, M. N. Noori, G.D. Buckner, T. Furukawa and Y. Suzuki, "Structural health monitoring and damage detection using an intelligent parameter varying (IPV) technique", *International Journal of Non-Linear Mechanics*, 39(10):1687-1697, 2004.
39. S.A. Saadat, G.D. Buckner, T. Furukawa, and M.N. Noori, "An Intelligent Parameter Varying (IPV) Approach for Non-linear System Identification of Base Excited Structures", *International Journal of Non-Linear Mechanics*, 39(6):993-1004, 2004.

40. G.D. Buckner, "Intelligent bounding of modeling uncertainties: applications to robust control", IEEE Transactions on Systems, Man, and Cybernetics - Part C: Applications and Reviews, Special Issue on Fusion of Soft Computing and Hard Computing in Industrial Applications, 32(2):113-124, May 2002.
41. G.D. Buckner, B. Fernandez, and G. Masada, "Intelligent sliding mode control of cutting force during single-point turning operations", ASME Journal of Manufacturing Science and Engineering, 123(2):206-213, 2001.
42. G.D. Buckner, K.T. Schuetze, and J.H. Beno, "Intelligent feedback linearization for active vehicle suspension control", ASME Journal of Dynamic Systems, Measurement, and Control, 123(4):727-733, 2001.
43. M.A. Pichot, J.P. Kajs, B.R. Murphy, A. Ouroua, B.M. Rech, J.H. Beno, G.D. Buckner and B. Palazzolo, "Active magnetic bearings for energy storage systems for combat vehicles", IEEE Transactions on Magnetics, 37(1):318-323, 2001.
44. Beno, J., Bresie, D., Weeks, D., Guenin, A., and Buckner, G., "Electromechanical Active Suspension Demonstration for Off-Road Vehicles at the University of Texas Center for Electromechanics", SAE Transactions, 2000-01(0102), 2000.
45. G.D. Buckner and K.T. Schuetze, "Intelligent estimation of system parameters for active vehicle suspension control", SAE Transactions, 1999(1), p. 729, 1999.
46. G.D. Buckner and M.L. Marziale, "Early steam leak detection can help limit boiler damage, avert explosion", Pulp and Paper Journal, 66(9):167-170, 1992.
47. G.D. Buckner and M.L. Marziale, "Westvaco uses acoustic leak detection system as preventative boiler maintenance tool", Pulp and Paper Journal, 66(10):81-84, 1992.
48. G.D. Buckner and S.J. Paradis, "Design and implementation of a commercial acoustic leak detection system for black liquor recovery boilers", TAPPI Journal (Technical Association of Pulp and Paper Industries), 73(7):121-127, 1990.

O. Peer-Reviewed Conference Publications

1. C. Haigh, J.H. Crews, G.D. Buckner, "Modeling and Experimental Validation of Shape Memory Alloy Bending Actuators", 2012 Smart Materials, Adaptive Structures, and Intelligent Systems (SMASIS) Conference, September 2012, Stone Mountain, GA.
2. J. Hannen, J.H. Crews, G.D. Buckner, "Indirect Intelligent Sliding Mode Control using Hysteretic Recurrent Neural Networks with Application to a Shape Memory Alloy Actuated Beam", 2012 Smart Materials, Adaptive Structures, and Intelligent Systems (SMASIS) Conference, September 2012, Stone Mountain, GA.
3. J.R. Archer, J.P. Lien, T. Fang and G.D. Buckner, "Closed Loop Control of Continuously Variable Geometry Sprays", 24th Annual Conference of the Institute for Liquid Atomization and Spray Systems (ILASS-Americas 2012), May 15-18, 2012, San Antonio, TX.

4. J.H. Crews, G.D. Buckner, "Multi-objective Design Optimization of a Shape Memory Alloy Actuated Robotic Catheter", proceedings of the 2011 Smart Materials, Adaptive Structures, and Intelligent Systems (SMASIS) Conference, September 2011, Scottsdale, AZ.
5. J.P. Lien, J. Zhang, T. Fang, G. D. Buckner, "Preliminary Testing of Sprays with Continuously Variable Spray Geometry", Proceedings of the ILASS-Americas 23rd Annual Conference on Liquid Atomization and Spray Systems, May 2011, Ventura, CA.
6. J.H. Crews and G.D. Buckner, "Multi-objective design optimization of a shape memory alloy actuated robotic catheter", Proceedings of the ASME 2011 Conference on Smart Materials, Adaptive Structures, and Intelligent Systems. September 18-21, 2011. Phoenix, AZ.
7. S.R. Jernigan, B. Fortney, Y. Fahmy and G.D. Buckner, "Implementing Effective Low-cost Laboratory Experiments into a Distance Engineering Program", Proceedings of the ASME 2010 International Mechanical Engineering Congress & Exposition (IMECE2010), November 12-18, 2010, Vancouver, British Columbia, Canada.
8. A.S. Veeramani, J.H. Crews, and G.D. Buckner, "Modeling Smart Materials Using Hysteretic Recurrent Neural Networks", ASME 2009 Conference on Smart Materials, Adaptive Structures and Intelligent Systems (SMASIS 2009), September 20-24, 2009, Oxnard, CA.
9. N.K. Noel, K. Tammi, G.D. Buckner, N.S. Gibson, "Intelligent Kalman Filtering for Fault Detection on an Active Magnetic Bearing System", Proceedings of the ASME Dynamic Systems and Control Conference (DSCC 2008), October 20-22, 2008, Ann Arbor, Michigan, USA.
10. A. Veeramani, J. Crews, G.D. Buckner, S.B. Owen, R. Cook, G. Bolotin, "Design and Control of a Shape Memory Alloy Actuated Robotic Catheter", Proceedings of the ASME Dynamic Systems and Control Conference (DSCC 2008), October 20-22, 2008, Ann Arbor, Michigan, USA.
11. K. Tammi, G. Buckner, J. Kortelainen, "Magneto-Rheological Squeeze-Film Damper for Semi-Active Control of Rotor Vibration", proceedings of the 9th International Conference on Motion and Vibration Control, Munich, Germany, September 15 - 18, 2008.
12. A. Veeramani, J.H. Crews, G.D. Buckner, S.B. Owen, R.C. Cook, G. Bolotin, "Development of a Shape Memory Alloy Actuated Catheter for Cardiovascular Procedures", Proceedings of the 3rd Annual Frontiers in Biomedical Devices Conference, Irvine, CA, June 2008.
13. M. Purser, D. Cormier, G. Buckner, R. Cook, and G. Bolotin, "Annuloplasty Band with Shape Memory Alloy Stiffener", Proceedings of the Materials & Processes for Medical Devices Conference and Exposition (MPMD 2007), Palm Desert, CA, September 2007.
14. B. Lu, H. Choi, G. D. Buckner "LPV Control Design and Experimental Implementation for a Magnetic Bearing System", Proceedings of the 2006 American Controls Conference, Minneapolis, MN, June 2006.
15. H. Choi, G. D. Buckner, and N.S. Gibson "Neural Robust Control of a High-Speed Flexible Rotor Supported on Active Magnetic Bearings", Proceedings of the 2006 American Controls Conference, Minneapolis, MN, June 2006.
16. P.S. Pandurangan and G.D. Buckner, "Non-destructive evaluation of metal-to-metal adhesive joints using vibration analysis: experimental results", Nondestructive Evaluation and Health

Monitoring of Aerospace Materials, Composites, and Civil Infrastructure V. Edited by Mufti, Aftab A.; Gyekenyesi, Andrew L.; Shull, Peter J. Proceedings of the SPIE, Volume 6176, pp. 103-111, 2006.

17. O. Zohni, G. Buckner, T. Kim, A. Kingon, J. Maranchi, and R. Siergiej, "Adhesion layer effects on the fabrication of MEMS-based PZT devices deposited on silicon nitride coated substrates", Proceedings of the Second International Symposium on Adhesion Aspects of Thin Films, Savannah GA, November 2005.
18. Lu, B., Choi, H., Buckner, G.D., "LPV control design and experimental implementation for a magnetic bearing system", Proceedings of the 31st Annual Conference of IEEE, IECON 2005, pp. 6-10, November 2005.
19. N.S. Gibson, G.D. Buckner, H. Choi, and F. Wu, "Confidence Interval Networks for Bounding Model Uncertainty: Experimental Evaluations on an Active Magnetic Bearing System", Proceedings of the 2005 IEEE Mid-Summer Workshop on Soft Computing in Industrial Applications (SMCia/05), Helsinki, Finland, June 28-30 2005, pp. 160-165.
20. S. Saadat, G. D. Buckner, M. N. Noori, and T. Furukawa: Structural Health Monitoring and Damage Detection Using the Intelligent Parameter Varying (IPV) Technique, Proceedings of the 5th Korea-Japan Seminar/Workshop on System Identification and Structural Health Monitoring, Dongguk University, Seoul, Korea, January 30-31 2004, pp. 199-207.
21. T. Furukawa, S. Saadat, M. Ishibashi, G. D. Buckner, and M. N. Noori: Structural Identification of Partially Nonlinear System Subjected to Seismic Excitation Using Intelligent Parameter Varying (IPV) Approach, Proceedings of the Third International Conference on Earthquake Engineering New Frontier and Research Transformation, Nanjing P. R. China, Oct. 19-20 2004, pp. 868-872.
22. B.M. Lawrence, G.A. Mirka, and G.D. Buckner, "System Identification Applied to the Biomechanical Response of Sudden Loading", Proceedings of the 2004 Industrial Engineering Research Conference (IERC), Houston, TX, May 2004.
23. D. Esterling, F.D. Caulfield, A.J. Kiefer, G.D. Buckner, and P. Jaju, "Non-contact Device for Measuring Frequency Response Functions of CNC Machine Tools", Proceedings of the International Mechanical Engineering Congress (IMECE2003), Washington, D.C., November 15-21, 2003.
24. D.W. Hood, G.D. Buckner, and T.A. Dow, "Force Feedback Control of Tool Deflection in Minature Ball End Milling", Proceedings of the American Society of Precision Engineering 18th Annual Meeting, Portland, OR, October 26-31, 2003.
25. N.S. Gibson, H. Choi, and G.D. Buckner, "H_∞ Control of Active Magnetic Bearings Using Artificial Neural Network Identification of Uncertainty", Proceedings of the 2003 IEEE International Conference on Systems, Man and Cybernetics, 2, pp. 1449-1456, 2003.
26. S.A. Saadat, G.D. Buckner, and M.N. Noori, "An Intelligent Parameter Varying Approach For Structural Health Monitoring and Damage Detection", Proceedings of the Ninth International Conference on Applications of Statistics and Probability in Civil Engineering (ICASP9), San Francisco, CA, July 6-9, 2003.

27. J.M. Stevens and G.D. Buckner, "Intelligent control of a micro-manipulator actuated with shape memory alloy tendons", SPIE's 10th Annual International Symposium on Smart Structures and Materials, San Diego, CA, March 2003.
28. S. Saadat, G.D. Buckner, T. Furukawa, and M.N. Noori, "An Intelligent Parameter Varying (IPV) Approach for Non-linear System Identification of Base Excited Structures", SPIE's 10th Annual International Symposium on Smart Structures and Materials, San Diego, CA, March 2003.
29. M.J. Craft and G.D. Buckner, "Fuzzy logic control algorithms for Magneshock semi-active vehicle shock absorbers: design and experimental evaluations", SPIE's 10th Annual International Symposium on Smart Structures and Materials, San Diego, CA, March 2003.
30. D. Hood, S. Clayton, G.D. Buckner, T.A. Dow, K. Garrard, "Closed loop control of milling tool deflection", Proceedings of the American Society of Precision Engineering 17th Annual Meeting, October 2002.
31. B.M. Lawrence, G.D. Buckner, and G.A. Mirka, "Nonlinear system identification applied to the biomechanical response of the human trunk during sudden loading", Proceedings of the Human Factors and Ergonomics Society's 46th Annual Meeting, Baltimore, MD, Sept 30-Oct 4, 2002.
32. S. Saadat, F.G. Yuan, M.N. Noori, and G.D. Buckner, "Estimation of Wind Loads on Structures", Proceedings of the 15th ASCE Engineering Mechanics Conference, no. 557, June 2002.
33. N. Gibson and G.D. Buckner, "Real-time adaptive control of active magnetic bearings using linear parameter varying models", Proceedings of IEEE SoutheastCon 2002, vol. 1, no. 1, pp. 268-272, 2002.
34. V. Jayanth, H. Choi, G.D. Buckner, "Identification and control of flexible structures supported on active magnetic bearings", Proceedings of IEEE SoutheastCon 2002, vol. 1, no. 1, pp. 273-278, 2002.
35. G.D. Buckner, "Intelligent bounds on modeling uncertainties: applications to sliding mode control of a magnetic levitation system", Proceedings of the 2001 IEEE International Conference on Systems, Man and Cybernetics, vol. 1, pp. 81-86, 2001.
36. M.T. Caprio, G.D. Buckner, and W.F. Weldon, "Controlling the torque-speed characteristics of a polyphase induction motor using a switched rotor ballast network", Proceedings of the 2001 American Control Conference, vol. 1, pp. 143-148, 2001.
37. G.D. Buckner, K.T. Schuetze and J. Beno, "Active vehicle suspension control using intelligent feedback linearization", Proceedings of the 2000 American Controls Conference, vol. 6, pp. 4014-18, 2000.
38. G.D. Buckner, "Intelligent sliding mode control of turning operations", Proceedings of the ISCA 9th International Conference Intelligent Systems, vol. 1, pp. 70-75, 2000.
39. J. Kajs, B. Murphy, H. Ouroua, B. Rech, R. Hayes, J. Beno, G. Buckner, and A. Palazzolo, "Active Magnetic Bearings for Energy Storage Systems for Combat Vehicles", 10th Electromagnetic Launch Technology Symposium (10th EML), San Francisco, CA, April 2000.

40. G.D. Buckner, A. Palazzolo, J. Kajs, B. Murphy J. Beno, "Control system for inside-out configuration active magnetic bearings", Proceedings of the 5th International Symposium on Magnetic Suspension Technology, Santa Barbara, CA, December 1999.
41. B.R. Fernández and G.D. Buckner, "Statistica: artificial neural networks for statistical bounding of data", Proceedings of the 4th IEEE Conference on Control Applications, vol. 1, pp. 554-559, 1995.
42. G.D. Buckner and M.L. Marziale, "Acoustic leak detection: a viable system for recovery boiler maintenance", proceedings of the Pulp and Paper Maintenance Conference 1990, November 1990.

P. Peer-Reviewed Research Abstracts

1. S.R. Jernigan, G.D. Buckner, "Selective Internal Radiation Therapy: Quantifying Distal Penetration and Distribution of Resin and Glass Microspheres in a Surrogate Arterial Model", World Congress on Interventional Oncology (WCIO 2014), New York, NY, May 2014.
2. C.D. Haigh, M.J. Mazzoleni, G.D. Buckner, "Quantitative Endpoints for Embolization Utilizing Real-Time Pressure Measurements: Anti-Reflux Infusion System versus End-hole Catheter", Society of Interventional Radiology, 38th Annual Scientific Meeting (SIR 2013), New Orleans, LA, April 2013.
3. E. Bean, G. Chanoit, S. Jernigan, G. Bolotin, J. Osborne, G. Buckner, "Evaluation of a New Atrial Retractor for Minimally Invasive Mitral Valve Repair in a Porcine Model", International Society for Minimally Invasive Cardiothoracic Surgery, 12th Annual Scientific Meeting (ISMICS 2009), San Francisco, CA, June, 2009.
4. A. Veeramani, J. Crews, G.D. Buckner, S.B. Owen, R. Cook, G. Bolotin, "Dynamic Behavior of a SMA Actuated Catheter", Proceedings of the Design of Medical Devices Conference (DMD 2008), Minneapolis, MN, April, 2008.
5. S.R. Jernigan, G.D. Buckner, J.W. Eischen, D.R. Cormier, "Finite element modeling of the left atrium to facilitate the design of an endoscopic atrial retractor", Proceedings of the 2nd Frontiers in Biomedical Devices Conference (BioMed 2007), Irvine, CA, June 7-8, 2007.
6. G.D. Buckner, N.J. Jardine, A.J. Kiefer, N.B. Campbell, M. Kocherginsky, J. Raman, V. Jeevanandam, G. Bolotin, "A Novel Instrumented Retractor to Monitor Tissue Disruptive Forces during Median Sternotomy", Proceedings of the Fifth Annual EACTS/ESTS (European Association for Cardio-Thoracic Surgery/European Society of Thoracic Surgeons) Joint Meeting, Stockholm, Sweden, September 9-13, 2006.
7. N. Jardine, G. Buckner, G. Bolotin, M. Kocherginsky, "Real-Time Monitoring and Control of Retraction Forces During Median Sternotomy", Proceedings of the 2006 Summer Bioengineering Conference, Amelia Island, FL, June 2006.
8. G. Bolotin, G. Buckner, N. Jardine, A. Kiefer, J. Raman, V. Jeevanandam, "A Novel Instrumented Retractor to Monitor Tissue Disruptive Forces during Lateral Thoracotomy", Proceedings of the Fourth Annual EACTS/ESTS (European Association for Cardio-Thoracic Surgery/European Society of Thoracic Surgeons) Joint Meeting, Barcelona, Spain, September 24-28, 2005.
9. G. Bolotin, G. Buckner, N. Jardine, A. Kiefer, J. Raman, V. Jeevanandam, "A Novel Instrumented Retractor to Monitor Tissue Disruptive Forces during Lateral Thoracotomy", Proceedings of the

Eighth Annual NewEra Cardiac Care: Innovation and Technology Conference, Dana Point, CA, January 7-9 2005.

10. J. Kuniholm, G. Buckner, J. Stevens, W. Nifong, M. Orrico, P. Douglas, and R. Nering, "An automated knot tying device for minimally invasive, robot assisted (MIRA) cardiac surgery", Proceedings of the International Society of Cardio-Thoracic Surgeons 13th World Congress, November 2-5, 2003, San Diego, CA.
11. J. Stevens, G. Buckner, J. Kuniholm, W. Nifong, M. Orrico, P. Douglas, and R. Nering, "An endoscopic atrial retractor for robotic mitral valve repair", Proceedings of the International Society of Cardio-Thoracic Surgeons 13th World Congress, November 2-5, 2003, San Diego, CA.

Q. Book Chapters

1. "Estimation of uncertainty bounds in sliding mode control", Chapter 5 in "Computationally Intelligent Hybrid Systems: The Fusion of Soft Computing and Hard Computing", IEEE Press, Piscataway, NJ, 2005.
2. "Adhesion layer effects on the fabrication of MEMS-based PZT devices deposited on silicon-nitride-coated substrates", Chapter 4 in Adhesion Aspects of Thin Films, Vol. 3, Brill Academic Publishers, Leiden, Netherlands, 2007.

R. Invited Presentations

1. "Quantitative Endpoints for Embolization Utilizing Real-Time Pressure Measurements: Anti-Reflux Infusion System versus End-hole Catheter", Society of Interventional Radiology, 38th Annual Scientific Meeting (SIR 2013), New Orleans, LA, April 2013.
2. "Classrooms Without Quizzes" faculty research panelist, NCSU Engineering Alumni Homecoming Reunion (NCSU EB-III), November 2 2012.
3. "Surgical Robotics", an invited presentation to the Pack Faculty Partner's Evening With A Star (NCSU Joyner Visitor Center), April 6 2011.
4. "Electromechanics Research in MAE: Applications to Minimally Invasive Surgery", an invited presentation to the Pi Tau Sigma (NC Pi Alpha Chapter), March 30 2010.
5. "Intelliject: Adaptive Fuel Injector Technology", NCSU Innovation Showcase: Changing the World, One Innovation at a Time, December 8 2009.
6. "Electromechanics Research in MAE: Applications to Minimally Invasive Surgery", an invited presentation to the MAE External Advisory Board, May 7 2009.
7. "Computer-Aided Design and Rapid Prototyping: Enabling Technologies for Surgical Device Development", an invited presentation to the Joint Meeting of the Eastern North Carolina Chapter/NCSU Student Chapter of ASME, March 17 2009.
8. Graduate Research in Electromechanics", an invited presentation to the Tau Beta Pi Honor Society, NCSU Chapter, April 15 2008.
9. "Intelliject: Adaptive Fuel Injector Technology", NCSU Innovation Showcase: Changing the World, One Innovation at a Time, January 17 2008.

10. "Lord, NCSU, and Electromechanics", an invited presentation for the Lord Corporation Visit to NC State University, NCSU, May 18 2007.
11. "Innovative Tools for Robot-Assisted Mitral Valve Repair", an invited presentation for the Advanced Medical Care Cluster Leadership Network, Wake Med Hospital, Raleigh, NC, May 2006.
12. "Confidence Interval Networks for Bounding Model Uncertainty: Experimental Evaluations on an Active Magnetic Bearing System", Proceedings of the 2005 IEEE Mid-Summer Workshop on Soft Computing in Industrial Applications, Helsinki, Finland, June 2005.
13. "Career Explorations in Mechanical Engineering", an invited presentation to rising 12th graders attending the Career Explorations in Science & Engineering Summer Camp, NC State University, Raleigh, North Carolina, June 12, 2005.
14. "Robust Control of a High-Speed Rotor Supported by Active Magnetic Bearings: An Intelligent Uncertainty Modeling Approach", An invited presentation for the University of Michigan Department of Mechanical Engineering Seminar, February 2005.
15. "A Novel Instrumented Retractor to Monitor Tissue Disruptive Forces during Lateral Thoracotomy", Eighth Annual NewEra Cardiac Care: Innovation and Technology Conference, Dana Point, CA, January 7-9 2005.
16. "Graduate Research in Mechanical and Aerospace Engineering at N.C. State", An invited presentation for the 2002 Pi Tau Sigma Induction Ceremony, N.C. State Chapter, November 2003.
17. 2002-2003 - NCSU ASME Technical Sessions (Spring 2003): Presented a seminar entitled "Simulink: a Graphical Tool for Dynamic System Simulation" to engineering students (of all disciplines) interested in this software tool.
18. "Graduate Research in Mechanical and Aerospace Engineering at N.C. State", An invited presentation for the 2002 Pi Tau Sigma Induction Ceremony, N.C. State Chapter, November 2002.
19. 2002-2003 - NCSU ASME Technical Sessions (Fall 2002): Presented a seminar entitled "Simulink: a Graphical Tool for Dynamic System Simulation" to engineering students (of all disciplines) interested in this software tool.
20. 2001-2002 - NCSU ASME Technical Sessions (Spring 2002): Presented a seminar entitled "Simulink: a Graphical Tool for Dynamic System Simulation" to engineering students (of all disciplines) interested in this software tool.
21. "Graduate Research in Electromechanics: From Racing to Robotics", An invited presentation to the American Society of Mechanical Engineers, NCSU Chapter, February 2002.
22. "Graduate Research in Mechatronics at N.C. State", An invited presentation to visiting undergraduate students from U.N.C. Asheville, February 2002.

23. "Electromechanics: Integrating 19th Century Theory with 21st Century Technology – Applications to Aerospace Systems", An invited presentation for the NASA LaRC Competency Directors, N.C. State University, September 2003.
24. "Graduate Research in Mechanical and Aerospace Engineering at N.C. State", An invited presentation for the 2002 Pi Tau Sigma Induction Ceremony, N.C. State Chapter, November 2002.
25. "Graduate Research in Electromechanics: From Racing to Robotics", An invited presentation to the American Society of Mechanical Engineers, NCSU Chapter, February 2002.
26. 2001-2002 - NCSU ASME Technical Sessions (Fall 2001): Presented a seminar entitled "Simulink: a Graphical Tool for Dynamic System Simulation" to engineering students (of all disciplines) interested in this software tool (approximately 50 attendees).
27. "Intelligent bounds on modeling uncertainties: applications to sliding mode control of a magnetic levitation system", IEEE International Conference on Systems, Man, and Cybernetics, Tucson, AZ, October 2001.
28. 2000-2001 - NCSU ASME Technical Sessions (Spring 2001): Presented a seminar entitled "Simulink: a Graphical Tool for Dynamic System Simulation" to engineering students (of all disciplines) interested in this software tool.
29. "Active Vehicle Suspension Control Using Intelligent Feedback Linearization", American Controls Conference, Chicago, IL, June 2000.
30. "Intelligent Sliding Mode Control of Turning Operations", 9th International Conference on Intelligent Systems (ICIS-2000), Louisville, KY, June 2000.
31. "Intelligent System Identification and Control: Applications to Nonlinear, Electromechanical Systems", presented at North Carolina State University, Mars Mission Research Center, Internal Review Meeting, February 9, 2000.

S. Research Grants

1. Title: "The Physics of Radioembolization: A Four-Stage Experimental Investigation of Distal Penetration and its Dependence on Microsphere Properties"
Principal Investigator: Gregory D. Buckner
Sponsor: Sirtex Medical, Inc.
Amount: \$219,700 (via NCSU Engineering Foundation)
Dates: January 1, 2012 - January 31, 2015

The primary objective of this industry-sponsored project is to experimentally investigate the effects of microsphere properties, specifically size and density, on distal penetration using 1X scale hepatic artery models. The effects of vessel compliance, dynamic pressurization, and fluid viscosity will be included.

2. Title: "Experimental Validation of Variable Geometry Spray Fuel Injection"
Principal Investigators: Gregory D. Buckner, Tiegang Fang
Sponsor: Chancellor's Innovation Fund (NCSU)
Amount: \$75,000

Dates: July 1, 2014 - June 30, 2015

The primary objective of this project is to experimentally demonstrate our patent-pending Variable Geometry Spray (VGS) fuel injection technology in an internal combustion engine and quantify improvements in fuel efficiency and reductions in emissions.

3. Title: "Quantitative Endpoints for Embolization Utilizing Real-Time Pressure Measurements: Anti-Reflux Infusion System versus End-hole Catheter"
Principal Investigator: Gregory D. Buckner
Sponsor: Surefire Medical, Inc.
Amount: \$20,000 (via NCSU Engineering Foundation)
Dates: April 26, 2012 - December 31, 2014

Embolization procedures are currently performed via hand infusion through an end-hole catheter; contrast agent flow dynamics provide a qualitative indicator of the degree of embolization. The purpose of this research is to determine the feasibility of monitoring real-time pressures as a quantitative endpoint for embolization.

4. Title: "A Novel Approach to the Treatment of Cardiac Arrhythmia: A Robotic Catheter for Epicardial Pacing Lead Placement (Phase 2 SBIR)"
Principal Investigators: Gregory D. Buckner, Shaphan R. Jernigan
Sponsor: NIH via LifeSciTech, Inc., Durham, NC
Amount: \$1,094,498 (\$445,949 via subcontract to NCSU)
Dates: August 1, 2010 – January 31, 2013
PINS: 37583

The primary objective of this Phase 2 SBIR proposal is to develop and demonstrate shape memory alloy (SMA) actuated catheter technology for minimally invasive surgery and cardiac catheterization. This technology has the potential to transform such procedures by providing unprecedented maneuverability, visualization, and access to open spaces within the body. Benefiting from the precision and repeatability of computer-based control, these catheters have the potential to impact a variety of medical fields, including cardiology, cardiac surgery, pediatric surgery and urology.

5. Title: "Variable Geometry Spray Fuel Injection: Investigating its Effects on Combustion Efficiency and Emissions"
Principal Investigators: Tiegang Fang, Gregory D. Buckner
Sponsor: National Science Foundation
Amount: \$330,000
Dates: July 16, 2009 – July 15, 2012
PINS: 31894

The primary objective of this research is to study the effect of variable geometry fuel injection on combustion efficiency and pollutant production of compression-ignition engines. To enable this investigation, the PIs have designed a novel injector capable of independently controlling the fuel spray cone angle and the fuel flow rate throughout the injection process. A prototype injector will be used to study the effect of the cone angle variation on air-fuel mixing, ignition, combustion, and pollutant formation. The injector features a movable pintle inside a specially shaped nozzle to produce a hollow-cone spray with a wide variation in spray angle (70° - 160°). The pintle will be controlled using a piezoelectric actuator which will provide precise positioning at high bandwidth. The fuel flow rate will be controlled by an independent solenoid actuator as

in conventional injectors. The device will be capable of smoothly varying the spray angle throughout the injection process.

6. Title: "A Novel Approach to the Treatment of Cardiac Arrhythmia: A Robotic Catheter for Epicardial Pacing Lead Placement (Phase 1 SBIR)"
Principal Investigators: Gregory D. Buckner, Shaphan R. Jernigan
Sponsor: NIH and NC matching funds via LifeSciTech, Inc., Durham, NC
Amount: \$240,736 (\$86,087 via subcontract to NCSU)
Dates: February 15, 2009 – November 15, 2009
PINS: 37583

The primary objective of this Phase I SBIR proposal is to develop and demonstrate shape memory alloy (SMA) actuated catheter technology that will result in the development of robotic catheters for minimally invasive surgery and catheterization in Phase II. This technology has the potential to transform such procedures by providing unprecedented maneuverability, visualization, and access to open spaces within the body. Benefiting from the precision and repeatability of computer-based control, these catheters have the potential to impact a variety of medical fields, including cardiology, cardiac surgery, pediatric surgery and urology.

7. Title: "Prototyping and Testing of a Smart Micro-Catheter for Radioactive Microsphere Targeting of Liver Tumors"
Principal Investigators: Clement Kleinstreuer, Gregory D. Buckner
Sponsor: Sirtex Medical, Sydney Australia
Amount: \$140,000 (via NCSU Engineering Foundation)
Dates: January 16, 2010 – December 31, 2012

The project involves the design, fabrication, and experimental demonstration of a robotic micro-catheter for the delivery of Y90 radioactive microspheres for radioembolization of liver tumors. A comprehensive study incorporating both computational and experimental investigations of microsphere transport in representative hepatic arterial systems is underway using a 4:1 scaled hepatic artery model. The primary goal is to provide new insight for optimal targeting of tumors, while sparing the surrounding healthy liver tissue and other organs.

8. Title: "Reciprocating Micro Saw for Reversible Canal Wall Down Tympanomastoidectomy"
Principal Investigator: Gregory D. Buckner
Sponsor: MicroSyntronics, Inc., Raleigh, NC
Amount: \$20,000 (via NCSU Engineering Foundation)
Dates: January 16, 2009 – August 15, 2009

The project involves the design of a lightweight, reciprocating microsaw for cutting bone in otolaryngology surgeries. The targeted procedure is the reversible canal wall down tympanomastoidectomy for the treatment of aural cholesteatomas. The procedure requires temporary removal of the posterior bony wall canal within a confined region.

9. Title: "Robotic Retraction for Minimally Invasive Pediatric Surgery"
Principal Investigator: Gregory D. Buckner
Sponsor: UNC-CH Department of Surgery, Division of Pediatric Surgery
Amount: \$20,000 (via NCSU Engineering Foundation)
Dates: January 16, 2009 – August 15, 2009

The objective of this research is to develop a robotically-actuated thoracic retractor for minimally invasive pediatric surgery.

10. Title: "Dynamic Tire Modeling for Off-Road Vehicles: Applications to Semi-Active Vehicle Suspensions"

Principal Investigator: Gregory D. Buckner

Sponsor: Lord Corporation

Amount: \$52,337

Dates: January 16, 2008 – May 15, 2009

The design of controllers for active and semi-active vehicle suspensions has been the focus of extensive research in recent years. Typically, low-order, linear, time-invariant models are used for control design and simulated performance evaluations. However, off-road vehicles experience large tire and suspension displacements, making nonlinear kinematics and damping characteristics significant. The objective of this research is to develop and experimentally validate dynamic models of tires and suspension components for off-road vehicles. The focus will be to optimize the accuracy/complexity tradeoff, so that these models may later be used for the synthesis of control algorithms for semi-active suspensions.

11. Title: "GE-F110 Agile Combat Support - Intelligent Event Detection"

Principal Investigator: Gregory D. Buckner

Sponsor: General Electric Aviation

Amount: \$50,441

Dates: August 16, 2006 – December 31, 2007

The objectives of this research are to assess the current state of the art of real-time event detection methods, including algorithms, techniques, architectures, and areas of implementation. Develop intelligent and novel ways to detect and diagnose anomalous system behavior. The platform upon which to test these methods will be a model of the GE F110 gas turbine engine.

12. Title: "Innovative Tools & Techniques for Robotic Heart Surgery"

Principal Investigator: Gregory D. Buckner

Co-Investigators: Randolph Chitwood, Wiley Nifong, Denis Cormier, Edward Grant, Bryan Laffitte

Sponsor: National Institute of Health (NIH)

Amount: \$1,347,825

Dates: 08/16/04-12/31/08

Minimally Invasive Robot-Assisted (MIRA) cardiac surgery results in increased patient satisfaction and decreased ICU and hospital stays. Unfortunately, these gains have been offset by significantly increased operative times and increased overall healthcare costs. Based on East Carolinas University's experience in MIRA mitral valve repairs, patient cardiopulmonary bypass times are currently increased approximately 60% (2.6 hrs with MIRA vs. 1.5 hours using conventional procedures). It is evident that critical technological advancements could significantly decrease MIRA operating times and improve patient outcomes. Accordingly, the specific aims of this multidisciplinary research program focus on developing technologies that facilitate and extend the capabilities of MIRA cardiac surgery. Near-term objectives involve the development of application-specific end effectors and instruments for existing surgical robot platforms. These include: (1) Devices for rapid and secure fixation of suture materials and prosthetic devices, specifically instruments and cartridges that provide "push-button" fixation

for specific procedures (e.g. atrial closure and leaflet repair) using both existing suture materials and advanced clips and staples. (2) Reliable and secure intra-atrial retractors to provide excellent visualization of essential cardiac structures: endoscopically-deployable retractors that utilize the superelastic and shape memory properties of Nitinol to facilitate totally closed surgical procedures.

13. Title: "Intelligent Control Systems for Active Magnetic Bearings: An Enabling Technology for Flywheel Energy Storage Systems"

Principal Investigator: Gregory D. Buckner

Sponsor: National Science Foundation Faculty Early Career Development (CAREER) Program

Amount: \$375,000

Dates: February 1, 2001 – January 31, 2006

The goal of this research is to develop self-learning AMB controllers for high speed, flexible rotors that will enable the development of practical flywheel systems for automotive and aerospace applications. These "intelligent" controllers characterize modeling uncertainties that, when fused with traditional robust control methods, adaptively improve performance and robustness. This technology may one day enable the mass production of low-cost flywheel systems that need no manual tuning. Furthermore, these systems will respond to parameter variations, disturbances, and sudden failures. This fusion of intelligent and traditional control is both innovative and applicable to a wide range of engineering problems.

14. Title: "Active Control of Tool Deflection and Chatter during Precision Milling Operations using Magnetic Bearing Spindles"

Principal Investigators: Thomas A. Dow, Gregory D. Buckner

Sponsor: National Science Foundation

Amount: \$360,000

Dates: September 1, 2001 – August 31, 2004

The primary research objective is to increase the quality and productivity of precision milling operations through the development of advanced control algorithms for magnetic bearing spindles. These real-time algorithms will correct for deflections in precision ball-end milling tools caused by cutting forces. The prime mover for these control algorithms will be a custom actuated air bearing spindle. Such a spindle is capable of creating the high surface speeds needed for miniature milling tools, can adjust the center of rotation to compensate for tool deflection, and has the high bandwidth necessary to provide active chatter compensation.

15. Title: "Electromechanical Actuator Development for Integrated Chatter Prediction and Avoidance on High-Speed Machining Centers"

Principal Investigator: Gregory D. Buckner

Sponsor: VulcanCraft, Inc.

Amount: \$117,344 (\$20,000 via Engineering Foundation)

Dates: October 1, 2000 – December 30, 2003

The primary research objective is to develop non-contacting, electromechanical actuators and capacitive sensors that will enable automated prediction of optimal spindle speeds for high-speed milling applications. These actuators deliver precise forcing profiles at multiple locations on machine tools for modal testing and prediction of stability lobe diagrams. Custom capacitive sensors enable accurate, high-bandwidth response measurements. This actuation and sensing technology, combined with receptance coupling theory, will result in a commercially viable

product that can be used to predict optimal machining conditions for any tool/toolholder/spindle combination.

16. Title: "Concurrent Development of Surgical Tools and Techniques for Minimally Invasive, Robot Assisted Cardiac Surgery"

Principal Investigator: Gregory D. Buckner

Sponsor: The Brody School of Medicine, East Carolina University (a subcontract of Ethicon's CardioVations R&D)

Amount: \$92,000 (\$17,000 via Engineering Foundation)

Dates: May 16, 2002 – August 15, 2003

The primary research objective is to develop prototype tools and surgical techniques specifically designed to overcome current limitations of minimally invasive, robot-assisted (MIRA) mitral valve surgery. With these tools and techniques, this research will demonstrate that the time and expense associated with MIRA mitral valve repair can be significantly reduced. Specifically, this research and development focuses on:

- Suturing and knot-tying devices specifically designed for tele-manipulated instruments
- Reliable and efficient intra-atrial retraction to improve indirect (videoscopic) visualization of mitral valves
- Surgical navigation technology to plan incisions and instrument trajectories around the unique cardiac anatomy of each patient

17. Title: "Development of an Eddy Current Door Closer"

Principal Investigator: Gregory D. Buckner

Sponsor: The National Collegiate Inventors and Innovators Alliance (Lemelson Foundation)

Amount: \$15,000

Dates: August 1, 2003 – September 31, 2004

The primary goal of this project is to develop an eddy current door closer, a feasible alternative to hydraulic door closers that can be constructed from passive electromechanical components. It uses permanent magnets and a rotating copper disk to generate braking torques similar to conventional devices. The eddy current door closer offers the following benefits: a) Reduced maintenance and environmental concerns due to elimination of hydraulic fluid b) Enhanced damping performance independent of environmental factors c) Low cost due to simplicity of design, ease of production, and readily available materials d) Enhanced adjustability by changing the air-gap.

18. Title: "Reliability Analysis and Life Prediction of Aircraft Structures"

Principal Investigators: Gregory D. Buckner, Mohammad Noori

Sponsor: The National Institute of Aerospace

Amount: \$100,000

Dates: October 1, 2002 – September 30, 2004

The primary goal of this project is to investigate reliability issues associated with aerospace structures due to uncertainties in both the structure and its loading. Particularly, this project will focus on how measurement data can be used to assess reliability and predict the remaining life of aerospace structures. A statistical Bayesian approach will be developed for system identification, structural health monitoring, and remaining life prediction. Experimental demonstrations will utilize measurement data from distributed sensing systems to demonstrate the merits of this approach.

19. Title: "Real-Time Structural Health Monitoring for Aerospace Structures"

Principal Investigators: Gregory D. Buckner, Fuh-Gwo Yuan

Sponsor: Goodrich Aerospace Faculty Fellowship

Amount: \$150,000

Dates: May 16, 2004 – May 15, 2007

To advance the application of real-time SHM to aerospace structures, experimental evaluations using benchmark structures, with realistic failure modes and sensor limitations, are necessary. Accordingly, the goal of this three-year research project involves the implementation and experimental evaluation of real-time SHM methods using benchmark aerospace structures. This multidisciplinary project will address the research interests of the Goodrich Corporation, and will benefit from research partnerships with the National Institute of Aerospace (NIA), NASA's Langley Research Center (LaRC), and the Naval Air Systems Command (NAVAIR). Research funds will be used to support one doctoral student and one undergraduate student in Mechanical Engineering at NC State University.

20. Title: "Development of a Dry Etch Process for Piezoelectric Materials and Electrical Characterization"

Principal Investigator: Gregory D. Buckner

Sponsor: Bechtel Bettis Atomic Power Laboratory

Amount: \$23,620.98

Dates: 01/01/04-12/31/04

The primary research objective is to develop a low frequency MEMS (MicroElectroMechanical Systems) vibration sensor that can be used to monitor deterioration and fatigue associated with mechanical equipment. The sensor will utilize either PZE (piezoelectric) or capacitive techniques to sense the vibration, and will discretize and detect frequencies over a specified range. The design will utilize numerical techniques such as FEA/BEM (finite element analysis/boundary element method) and reduced-order modeling to optimize the design. The fabrication and testing of this sensor will require extended access to the Thin Films Laboratory at North Carolina State University, MEMS process supplies and materials, and supplies for electromechanical test and measurement.

21. Title: "Development of Wet and Dry Etch Process for Piezoelectric Membranes"

Principal Investigator: Gregory D. Buckner

Sponsor: Bechtel Bettis Atomic Power Laboratory

Amount: \$27,667

Dates: 01/01/05-7/31/06

The primary goal of this research will be to develop alternative etch processes for piezoelectric (PbZrx, Ti1-xO3) membranes. PZT micro-electromechanical systems (MEMS) are currently being investigated as potential low-frequency vibration sensors, and the proposed work will be highly complementary. The scope of work includes: 1) deep reactive ion etching for silicon, 2) alternative masking for extended wet etching of silicon, 3) reactive ion etching for electrodes, 4) alternative wet etching for electrode definition, 5) investigation of thin film stress reduction through modeling and optimization of test structures, and 6) reporting on findings and delivery of characterized prototypes.

22. Title: "Development of a Low-Frequency MEMS Vibration Sensor for Mechanical Equipment Monitoring"

Principal Investigator: Gregory D. Buckner

Sponsor: U.S. Department of Energy (Supplemental Funding via Naval Nuclear Propulsion Program)

Amount: \$9,500

Dates: 08/01/04-07/31/05

These funds will be used to support laboratory work critical to Mr. Zohni's NNP Fellowship. Although many laboratory fees are covered by student tuition (i.e. computer labs, digital imaging labs, course labs, etc.) the clean rooms at North Carolina State University require research separate funds for access and supplies. These funds would usually be included in a research grant proposal, but Mr. Zohni's fellowship includes no funding for laboratory work.

23. Title: "Reactive ion etcher with the flexibility of an inductively coupled plasma"

Principal Investigators: Doug Barlage, Gregory Buckner, Mark Johnson, Angus I. Kingon, Jon-Paul Maria, John Muth, Troy Nagle, Carlton Osburn, Greg Parsons

Sponsor: NSF Major Research Instrumentation Program (MRI)

Amount: \$500,000

Dates: 01/01/04-12/31/04

24. Title: "Real-Time Control Algorithms for MagneShock™ Semi-Active Shock Absorbers: Development and Demonstration"

Principal Investigator: Gregory D. Buckner

Sponsor: Carrera, Inc.

Amount: \$21,203 (Engineering Foundation Account)

Dates: June 1, 2001 – December 31, 2002

The primary objective of this project was to improve the performance of MagneShock™ shock absorbers through design optimization and through the development of advanced, real-time control algorithms. Specifically, this research:

- Optimized the electromechanical design of existing MagneShock prototypes to reduce magnetic saturation and improve efficiency and performance
- Developed fuzzy logic control (FLC) algorithms to adjust MagneShock damping levels in real-time
- Implemented and evaluated these FLC algorithms on a vehicle; road tests revealed significant improvements in ride quality and handling performance

25. Title: "Phase 2: Electromechanical Linear Actuators For Improved Productivity of Blade and Cartridge Assembly Processes"

Principal Investigator: Gregory D. Buckner

Sponsor: The Gillette Company

Amount: \$29,126

Dates: April 15, 2002 – May 31, 2003

The primary objective of this Phase 2 research project remains to improve the productivity, quality, and adaptability of Gillette's blade and cartridge assembly machines by incorporating electromechanical linear actuators. These actuators, with embedded high-resolution encoders and load cells, will enable precise, adaptable control of displacement and force at selected assembly stations. Specifically, these actuators have the potential to:

- Replace mechanical cam and linkage subsystems that transform rotational motion into linear motion

- Provide enhanced flexibility for design changes and lockout operations
- Reduce design time, noise, vibration, and machine size
- Ensure proper assembly and quality control

26. Title: "Electromechanical Linear Actuators For Improved Productivity of Blade and Cartridge Assembly Processes"

Principal Investigator: Gregory D. Buckner

Sponsor: The Gillette Company

Amount: \$39,716

Dates: March 30, 2001 – December 20, 2001

The objective of this research was to improve the productivity, quality, and adaptability of Gillette's blade and cartridge assembly machines by incorporating electromechanical linear actuators. These actuators, with embedded high-resolution encoders and load cells, enabled precise, adaptable control of displacement and force at selected stations. Specifically, these actuators could:

- Replace mechanical cam systems that transform rotational motion to linear motion
- Monitor linear position to ensure proper assembly
- Monitor assembly force for improved quality control
- Provide flexibility for design changes and lockout operations
- Reduce design time, noise, vibration, and machine size

27. Title: "Conceptual Design and Development Of a Semi-Autonomous, Micro-Robotic Surgical Instrument"

Principal Investigator: Gregory D. Buckner

Sponsor: The Brody School of Medicine, East Carolina University (a subcontract of the Doris Duke Foundation)

Amount: \$17,500

Dates: August 1, 2001 – June 30, 2002

The primary objective of this project is to develop a conceptual design for a semi-autonomous, micro-robotic medical instrument that would assist in minimally invasive surgery. Specifically, this research will:

- Investigate and analyze the primary needs for improvement on existing tele-robotic surgical systems
- Develop a conceptual design using miniature actuation techniques and programmable instrumentation to meet the needs of the surgeon and the patient

28. Title: "Trans-Permanent Magnet (T-PM) Actuators for Space Antennas"

Principal Investigator: Gregory D. Buckner

Sponsor: North Carolina Space Grant Consortium Research Seed Grant

Amount: \$7,732 (\$3,866 + \$3,866 MAE Match)

Dates: January 1, 2000 – December 31, 2000

The primary objective of this project was to develop prototype linear actuators that demonstrate the potential of Trans-Permanent Magnet (T-PM) technology for low-power, high-resolution, micro-positioning applications. These prototype actuators provided baseline performance specifications (force capability, positional resolution, power density, etc.) essential for pursuing additional research funding and establishing a long-term research program.

T. Professional Activities and Committee Work

1) Conference chairmanship

(a) Session Chair, ASME 2009 Conference on Smart Materials, Adaptive Structures and Intelligent Systems, Oxnard, CA, September 2009

(b) Session Co-Chair (Control and Magnetic Bearings), American Controls Conference (ACC-2006), Minneapolis, MN, June 2006

(c) Session Chair (Soft Computing and Applications I), 2005 Mid-Summer Workshop on Soft Computing in Industrial Applications, Helsinki University of Technology, Espoo, Finland June 28-30, 2005

(d) Session Organizer and Co-Chair (Structural Control, Health Monitoring, and System Identification), 9th ASCE Joint Specialty Conference on Probabilistic Mechanics and Structural Reliability (PMC04), Albuquerque, NM July 26-28, 2004

(e) Session Chair, American Controls Conference (ACC-2000), Chicago, IL, June 2000

2) Professional committees

(a) 2007-Present: Member, ASME Mechatronics Technical Committee

(b) 2007-Present: Member, ASME Model Identification and Intelligent Systems Technical Committee

(c) 2008-Present: Member, NIH Center for Scientific Review Special Emphasis Panel: Computational Modeling and Sciences for Biomedical and Clinical Applications. Reviewed NIH R01, R21, R41/42 (STTR), R43/44 (SBIR), RC-2, S10 and GO proposals (July 2008, March 2009, July 2009, November 2009, February 2010, November 2010, February 2011, June 2011, February 2012 (Acting Chair), October 2012, February 2013, November 2013, February 2014)

3) Referee services

(a) Journal Reviews: ASME Journal of Dynamic Systems, Measurement, and Control, ASME Journal of Computational and Nonlinear Dynamics, ASME Journal of Manufacturing Science and Engineering, ASME Journal of Vibration and Acoustics, IEEE Transactions on Control Systems Technology, IEEE Transactions on Industrial Electronics, IEEE Transactions on Systems, Man, and Cybernetics - Part C: Applications and Reviews, The Royal Society Proceedings A: Mathematical, Physical, and Engineering Sciences, International Journal of Vehicle Design; Annals of Biomedical Engineering; International Journal of Modelling and Simulation; Journal of Robotics

(b) Conference Reviews: American Controls Conference, Conference on Decision and Control, BIOCAS 2008, American Society for Engineering Education (ASEE) Annual Conference and Exposition 2009

(c) Proposal Reviews: NIH Proposal Review Panel (July 2008, March 2009, July 2009, November 2009, February 2010, November 2010, February 2011, June 2011, February 2012, October 2012, February 2013); DOE EPSCoR Louisiana Proposal Review Panel (June 2011); South Carolina Research Initiative Grants

(d) Textbook Reviews: Dynamics text proposal, Oxford Press

4) Professional associations

(a) Pi Tau Sigma - Mechanical Engineering Honor Society (Faculty Advisor, NCSU Chapter, 2007-2013)

(b) Tau Beta Pi - Engineering Honor Society

(c) Phi Kappa Phi - Academic Honor Society

(d) Sigma Xi – Scientific Research Honor Society

(e) American Society of Mechanical Engineers (ASME)

(f) Institute of Electrical and Electronics Engineers (IEEE)

(g) American Society for Engineering Education (ASEE)