

## **Alan Andrew Barhorst, Ph.D., P.E.**

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Vita updated: November 10, 2010

### **Education**

Ph.D., M.S., B.S.: Mechanical Engineering, Texas A&M University, 1991, 1989, 1984.

### **Professional Experience**

1. Professor: Department of Mechanical Engineering, Texas Tech University, September, 2006–present.
2. Visiting Professor, Program Coordinator: Department of Mechanical Engineering, Texas A&M University at Qatar, July, 2007–July, 2008.
3. Faculty Development Leave, Sandia National Labs, Center for Integrated Nanotechnology (CINT), Fall 2006.
4. Los Alamos National Laboratory Dynamics Summer School Mentor and Visiting Researcher, 2004–2006.
5. Associate Professor: Department of Mechanical Engineering, Texas Tech University, September, 1998–August, 2006.
6. Summer Faculty Fellow: ASEE/NASA (Johnson Space Center), 1993, 1994.
7. Assistant Professor: Department of Mechanical Engineering, Texas Tech University, September, 1992–August, 1998.
8. Visiting Assistant Professor: Department of Mechanical Engineering, Texas Tech University, September, 1991–August, 1992.
9. Teaching and Research Assistant: Department of Mechanical Engineering, Texas A&M University, 1986, January 1988–August, 1991.
10. Engineer: Lockheed EMSCO, Houston, Texas, 1985, 1987.
11. CNC Machinist: Millco Enterprises, Houston, Texas, 1979–1980.

### **Professional Registration**

1. Professional Engineer, Texas, #79176.

### **Professional Interests**

Bio-Mechanics, Control System Design, Dynamics, Design, Fluid-Structure Interaction, Manufacturing, Mechanics, Mechatronics, Micro-Electro-Mechanical Systems, Multi-body Elasto-dynamics, Non-Destructive Evaluation–Acoustic Emissions, Robotics, System Dynamics, Vibrations, and Wavelet Based Signal Processing.

## Professional Societies

1. Member, American Society of Mechanical Engineers (ASME).
2. Member, American Society for Engineering Education (ASEE).
3. Member, American Institute of Aeronautics and Astronautics (AIAA).
4. Founding Member, Society for Design and Process Science (SDPS).

## Consulting Interests/Service

1. Automation, Control Systems, Design, Design Analysis, Dynamics, System Dynamics, Vibrations, and Robotics.
2. *M<sup>3</sup>P* Engineering Services (Registered in Texas). Current Clients: Simmons Pump Corp., Lubbock, Texas; Bryan Cave/Royal Vendors Inc., St. Louis, Missouri; Kelly Hart & Hallman/Frac Tech Services LTD, Cisco, Texas.

## Awards and Fellowships

1. Center for Integrated Nanotechnologies (DOE-Sandia) Research Fellow, 2006–2009.
2. Los Alamos Dynamics Summer School Mentor and Research Fellow, Summers 2004–2006.
3. Nominated and finalist for the TBII Outstanding Professor Award, Spring 2003.
4. Pi Tau Sigma (ΠΤΣ) Mechanical Engineering Honor Society, Texas Tech Chapter, “Outstanding Professor of Mechanical Engineering,” Fall 1996, Spring 2002.
5. Summer Faculty Fellow: ASEE/NASA (Johnson Space Center), 1993, 1994.

## Postdoctoral Fellows

1. Chun Nam (Simon) Wong, PhD, 2005-2007. Topic: Nonlinear structural dynamics, Parameter estimation in nonlinear systems, and structural health monitoring.

## Graduate Students

1. Chris J. Guggenberger (*Raytheon*), Transdisciplinary, Design, Process, and Systems Ph.D., current. Topic: Sensor Fusion for Simple Robotic platforms for Martian exploration.
2. Christopher Umstead, Ph.D., current. Chancellor’s Fellowship Awardee. Topic: Neural Tissue Shock Loading.
3. Crystal Baker, M.S., current. Topic: Simple Robotic platforms for Martian exploration.
4. Oliver Harrison, B.S./M.S. (*SwRI*), current. Topic: Studies in Hybrid Parameter Mechanical Systems modeling.
5. Simeon Symeonidis (*Raytheon*), Transdisciplinary, Design, Process, and Systems Ph.D., August, 2009. Topic: Electro-optical systems and neural-inspired processing with applications to law enforcement small arms fire indication systems.

6. Ross Wilson (*FMC*), M.S., August, 2007. Topic: Anterior Cruciate Ligament Injury Studies Using Robots.
7. Gagan Deep Bhasin, M.S., August, 2005. Topic: Robotics in Bio-Mechanical Applications.
8. Ranjith Poduval, M.S., December, 2005. Topic: Design and Construction of Leg Bone Jigs for Staubli Robot.
9. John T. Foster (*Sandia National Lab*), M.S., December, 2004. Topic: Enhanced Dynamic Modeling of Bolted Joints in Structural Systems.
10. Scott E. Rose (*Sandia National Lab*), M.S., December, 2004. Topic: Fluid-Structure Interaction Modeling for Martian Tumbleweed Instrument Platform.
11. Griffin C. Phillips (*PPP, Ind. Oil & Gas Exp.*), M.S., December, 2004. Topic: Wavelet based Reanalysis of Seismic Data for Oil Exploration.
12. Preeda Meekangvan (*Western Digital*), M.S., August, 2004. Topic: Articulated Elastic System Modeling Applied to Avian Jaw Kinesis.
13. Aeerook Kim (*Samsung*), M.S., August, 2004. Topic: System Redesign of NASA EDU Plant Growth Chamber.
14. Cody B. Moody (*Raytheon*), M.S., May, 2004. Topic: Neuromuscular Control of Elastic Skeletal Systems.
15. Taek Hyun Jang, M.S., May, 2001. Topic: Machine Dynamics
16. P. Christian Bunaes (*Schlumberger*), M.S., December, 1999. Topic: Mechatronic development of flexible manipulator testbed.
17. Seralaathan Hariharesan (*Traxxas R&D*), M.S., 1992; Ph.D., May, 1998. Topic: Contact/impact dynamics in flexible multiple body systems.
18. Steven King (*Lockheed Martin*), M.S., December, 1998. Topic: Modeling of closed loop flexible body mechanical systems.
19. Angela L. Nugent (*Applied Materials*), M.S., December, 1997. Topic: Modeling multi-point contact in dexterous robotic devices.
20. Jose Ortiz (*MSC Software*), Ph.D., December, 1996. Topic: Structure fluid interaction in flexible multiple body systems.
21. Gang Qi (*University of Memphis*), Ph.D., August, 1996. Topic: Acoustic emission based nondestructive evaluation via wavelet transforms.
22. Patrick Omoridion, M.S., 1994. Topic: Finite Element Analysis of Dish-Sterling Solar Array.
23. Thomas Chern (*Philips Semiconductors, Taiwan*), M.S., 1994. Topic: Structural Dynamics.
24. Satish Ganti, M.S., 1994. Topic: Structural Dynamics

## Textbooks

1. *Dynamics for Engineering Practice*, by Louis J. Everett and Alan A. Barhorst, McGraw-Hill Custom Publications, 2004, ISBN#: 0-07-301547-4.
2. Contributing Author to: *Understanding Engineering Systems Via Conservation*, by L.J. Everett, McGraw-Hill, 1991.

## Journal Papers

1. Ross Wilson, Christopher Umstead, and Alan Barhorst (2010). In vitro Study of Impingement of the Anterior Cruciate Ligament Against the Intercondylar Notch. *American Journal of Sports Medicine*, in review.
2. Symeonidis, S. and Barhorst, A. A. (2009). Law-Enforcement Small Arms Detection and Discrimination using Neural Networks. *Neural Computing and Applications*, in review.
3. Joel R. Feenstra, Tyler F. Winter, Brandon R. Dierschke, and Alan Barhorst (2010). Modeling Loose Joints in Elastic Structures—Validation at Higher Excitation Frequencies. *Journal of Vibration and Control*, accepted for publication.
4. Wong, C-N Simon., and Barhorst, A. A. (2009). General Order Perturbation with Skew-symmetric Approach for Structural Health Monitoring of Modular Beam. *Journal of Vibration and Control*, 15(12):1763-1781.
5. Barhorst, A. A. and Schovanec, L. (2009). A Neuro-Muscular Elasto-Dynamic Model of the Human Arm—Part 1: Model Development. *Journal of Bionic Engineering*, 6(2):93-107.
6. Moody, C. B., Barhorst, A. A. and Schovanec, L. (2009). A Neuro-Muscular Elasto-Dynamic Model of the Human Arm—Part 2: Musculotendon Dynamics and Related Stress Effects. *Journal of Bionic Engineering*, 6(2):108-119.
7. J. T. Foster, Jr., A. A. Barhorst, C. N. Wong, and M. T. Bement (2009). Modeling Loose Joints in Elastic Structures—Experimental Results and Validation. *Journal of Vibration and Control*, 15(4):549-565.
8. Barhorst, A. A. (2009). Modeling Loose Joints in Elastic Structures—Simulation Algorithm and Results. *Journal of Vibration and Control*, 15(1):3-24.
9. Barhorst, A. A. (2008). Modeling Loose Joints in Elastic Structures—Momentum Transfer Model Development. *Journal of Vibration and Control*, 14(12):1803-1841.
10. Barhorst, A. A. (2008). Modeling Loose Joints in Elastic Structures—Variable Structure Motion Model Development. *Journal of Vibration and Control*, 14(11):1767-1797.
11. Wong, Chun-Nam, and Barhorst, A. A. (2007). Stochastic analysis of Poisson impact series using discrete form, spectrum analysis and time correlation. *Mechanical Systems and Signal Processing*, 21(1):151-164.
12. C. N. Wong and A. A. Barhorst (2006). Parameter Identification of Nonlinear Hybrid Parameter Multibody Dynamic System with Contact using a Polynomial Interpolated Taylor Series Method. *Journal of Nonlinear and Computational Dynamics*, 1(3):248-256.

13. Meekangvan, P., Barhorst A. A., Burton, T. D., Chatterjee, S., and Schovanec, L. (2006). Nonlinear Dynamical Model and Response of Avian Cranial Kinesis. *The Journal of Theoretical Biology*, 240(1):32-47.
14. Rose, S. E., Moody, C. B., James, D. L., and Barhorst, A. A. (2006). Drag Measurement and Dynamic Simulation of Martian Wind Driven Sensor Platform Concepts. *Journal of Fluids and Structures*, 22(1):21-43.
15. Barhorst, A. A. (2004). Systematic Closed Form Modeling of Hybrid Parameter Multiple Body Systems. *The International Journal of Nonlinear Mechanics*, 39(1):63-78.
16. Barhorst, A. A. (2004). On the Efficacy of Pseudo-Coordinates—Part 1: Moving Interior Constraints. *The International Journal of Nonlinear Mechanics*, 39(1):123-135.
17. Barhorst, A. A. (2004). On the Efficacy of Pseudo-Coordinates—Part 2: Moving Boundary Constraints. *The International Journal of Nonlinear Mechanics*, 39(1):137-151.
18. Kamala, G. P. and Hashemi, J. and Barhorst, A. A. (2001). Discrete Wavelet Analysis of Acoustic Emissions During Fatigue Loading of Carbon Fiber Reinforced Composites. *Journal of Reinforced Plastics and Composites*, 20(3):222–238.
19. Hariharesan, S. and Barhorst A. A. (1999). Modeling, Simulation and Experimental Verification of Contact/Impact Dynamics in Flexible Multiple-Body Systems. *Journal of Sound and Vibration*, 221(4):709–732.
20. Barhorst, A. A. (1998). Contact/Impact in Hybrid Parameter Multiple Body Mechanical Systems—Extensions for Higher Order Continuum Models. *ASME Journal of Dynamic Systems, Measurement, and Control*, 120(1):142–144.
21. Barhorst, A. A. (1998). On Modeling Variable Structure Dynamics of Hybrid Parameter Multiple Body Systems. *Journal of Sound and Vibration*, 209(4):571–592.
22. Ortiz, J. L., Barhorst A. A., and Robinett, R. D. (1998). Flexible Multibody Systems—Fluid Interaction. *International Journal of Numerical Methods in Engineering*, 41(3):409–433.
23. Ortiz, J. L. and Barhorst A. A. (1998). Large-Displacement Nonlinear Sloshing in 2-D Circular Rigid Containers—Prescribed Motion of the Container. *International Journal of Numerical Methods in Engineering*, 41(2):195–210.
24. Barhorst, A. A. (1998). Symbolic Equation Processing Utilizing Vector/Dyad Notation. *Journal of Sound and Vibration*, 208(5):823–839.
25. Ortiz, J. L. and Barhorst A. A. (1997). Closed-Form Modeling of Fluid-Structure Interaction Problems with Nonlinear Sloshing—Potential Flow. *AIAA Journal*, 35(9):1510–1517.
26. Qi, G. and Barhorst, A. A. (1997). On Predicting The Fracture Behavior of CFR and GFR Composites Using Wavelet-Based AE Techniques. *Engineering Fracture Mechanics*, 58(4):363–385.
27. Qi, G., Barhorst, A. A., Hashemi, J., and Kamala, G. (1997). Discrete Wavelet Decomposition of AE Signals from CFR Composites. *Composite Science and Technology*, 57(4):389–403.

28. Ortiz, J. L. and Barhorst A. A. (1997). On Modeling Structure Fluid Interaction. *AIAA Journal of Guidance Control and Dynamics*, 20(4):1221–1228.
29. Barhorst, A. A. and Everett, L. J. (1995). Contact/Impact in Hybrid Parameter Multiple Body Mechanical Systems. *ASME Journal of Dynamic Systems, Measurement, and Control*, 117(4):559–569.
30. Barhorst, A. A. (1995). An Alternative Derivation of Some New Perspectives on Constrained Motion. *ASME Journal of Applied Mechanics*, 62(1):243–245.
31. Barhorst, A. A. and Everett, L. J. (1995). Modeling Hybrid Parameter Multiple Body Systems: A Different Approach. *The International Journal of Nonlinear Mechanics*, 30(1):1–21.

### Refereed Conference Papers

1. Symeonidis, S. and Barhorst, A. A. Electro-Optical Systems and Neural-Inspired Processing: A System Architecture and Technology Analysis with Applications to Law Enforcement Small Arms Fire Indication Systems. *In Proceeding of The ATLAS Transdisciplinary-Transnational-Transcultural Bi-Annual Meeting*, May 23-28, 2010, Southwestern University, Georgetown, Texas.
2. Alan Barhorst and Lawrence Schovanec. Application of hybrid parameter methods to biomechanical systems. *In Proceedings Chinese Control and Decision Conference (CCDC)*, July 2-4, 2008, Yantai, China, pages 839-843.
3. A. A. Barhorst, O. P. Harrison, and G. D. Bachand. Modeling Elasto-Mechanical Phenomena Involved in the Motor-Driven Assembly of Nanomaterials. *In Proceedings of ASME International Design Engineering Technical Conferences*, September 4-7, 2007, Las Vegas, Nevada, USA, Paper DETC2007-34175.
4. Joel R. Feenstra, Tyler F. Winter, Brandon R. Dierschke, and Alan Barhorst (2007). Model validation of Loose Bolted Joints in Damaged Structural Systems. *In Proceedings of the IMAC XXIV conference*, February, Orlando, FL.
5. Jared Collins, Matt Nothnagel, Jake Pretko, and Alan Barhorst (2006). Model validation of Loose Bolted Joints in Damaged Structural Systems. *In Proceedings of the IMAC XXIII conference*, Jan. 30-Feb. 2, St. Louis, MO.
6. Alan A. Barhorst and Darryl L. James (2006). Elasto-dynamic Model of a Segmented Martian Tumbleweed Concept. *Proceedings of the 44th AIAA Aerospace Sciences Meeting*, Paper No. 2006-0068, January, Reno, NV.
7. J. T. Foster, Jr., A. A. Barhorst, C. N. Wong, and M. T. Bement (2005). Modeling and Experimental Verification of Frictional Contact-Impact in Loose Bolted Joint Elastic Structures. To appear in *The 5<sup>th</sup> ASME International Conference on Multibody Systems, Nonlinear Dynamics and Control*, Paper No. DETC2005-85465, Long Beach, CA.
8. C. N. Wong and A. A. Barhorst (2005). Parameter Identification of Nonlinear Hybrid Parameter Multibody Dynamic System with Contact using a Polynomial Interpolated Taylor Series Method. To appear in *The 5<sup>th</sup> ASME International Conference on Multibody*

*Systems, Nonlinear Dynamics and Control*, Paper No. DETC2005-84742, Long Beach, CA.

9. Laura Jacobs, Adam Rosenbaum, Nick Stites, Matt Bement, Alan Barhorst (2005). Assessment of Robust Control on Damage Growth. *In Proceedings of the IMAC XXII conference*, February, Orlando, FL.
10. S. Rose, C. Moody, D. L. James, and A. A. Barhorst (2005). Drag Measurement and Dynamic Simulation of Martian Wind Driven Sensor Platform Concepts. *In Proceedings of the 43rd AIAA Aerospace Sciences Meeting*, Paper No. 2005-249, January, Reno, NV.
11. Moody, C. B., Barhorst, A. A. and Schovanec, L. (2003). A Neuro-Muscular Elasto-Dynamic Model of the Human Arm. *Proceedings of 2003 ASME International Mechanical Engineering Congress & Exposition*, Washington, D.C., November 16-21.
12. Barhorst, A. A. and Schovanec, L. (2002). Effects of Control Strategies on Stress Development in Skeletal Structures. *Proceedings of 2002 American Control Conference*, Anchorage, Alaska, May 8-10, pp 2319-2322.
13. Barhorst, A. A. and Schovanec, L. (2001). Optimal Motor Control Strategies and a Hybrid Approach to Stress Analysis in Skeletal Systems. *Proceedings of the American Control Conference*, Arlington, VA, June 25-27, pp 236-240.
14. Barhorst, A. A. and Schovanec, L. (2000). A Hybrid Approach to Stress Analysis in Skeletal Systems. *Proceedings of the 39th IEEE Conference on Decision and Control*, Sydney, Australia, pp 1788-1793.
15. Kamala, G. P. and Hashemi, J. and Barhorst, A. A. (1998). Discrete Wavelet Analysis of Acoustic Emissions During Fatigue Loading of Carbon Fiber Reinforced Composites. *Recent Advances in Solids and Structures*, ASME, PVD-Vol. 381, pp 129-140.
16. King, S. A. and Barhorst, A. A. (1998). Dynamic Modeling and Experimental Verification of a Flexible-Follower Quick-Return Mechanism. *In Proc. of The 35th Annual Technical Meeting, Society of Engineering Science*. September, 27-30, Pullman, Washington.
17. Hariharesan, S. and Barhorst, A. A. (1998). Modeling, Simulation and Verification of Contact/Impact Dynamics in Flexible Articulated Structures. *In Proc. of The 35th Annual Technical Meeting, Society of Engineering Science*. September 27-30, Pullman, Washington.
18. Nugent A. L. and Barhorst, A. A. (1998). Minimal Modeling of Multi-Point Contact with Friction in Multiple Rigid Body Systems. *In Proc. of The 35th Annual Technical Meeting, Society of Engineering Science*. September 27-30, Pullman, Washington.
19. Redd, J and Volz, R. A. and Barhorst, A. A., et al. (1997). Remote Viewing and Inspection of Radioactive Sites. *In Proc. of The ANS 7th Topical Meeting on Robotics & Remote Systems*. April 27–May 1, Augusta, Georgia.
20. Barhorst, A. A and Volz, R. A. and Kondraske, G. V. (1997). Robotics, Automation, and Tele-Operation Program for Safe Handling and Long-Term Storage of Nuclear Components. *In Proc. of The ANS 7th Topical Meeting on Robotics & Remote Systems*. April 27–May 1, 1997, Augusta, Georgia.

21. Ortiz, J. L. and Barhorst A. A. (1997). On Modeling Fluid Structure Interaction. *In Proc. of The 35th Aerospace Sciences Meeting and Exhibit, Modeling and Control of Multi-Body Dynamical Systems*. January 6-9, Reno, Nevada.
22. Barhorst A. A. (1997). On Modeling Mechanical Systems with Spatially and Temporally Varying Boundary Conditions. *In Proc. of The 35th Aerospace Sciences Meeting and Exhibit, Modeling and Control of Multi-Body Dynamical Systems*. January 6-9, Reno, Nevada.
23. Qi G., Barhorst, A. A., and Hashemi, J. (1996). Discrete Wavelet Analysis of Acoustic Emission—Identification of CFR Composite Failure Modes. *In Proceedings of the 1996 VIII International Congress on Experimental Mechanics*, Pages 188–195.
24. Barhorst, A. A. (1996). Vector/Dyad Notation in Computer Symbolic Modeling of Hybrid Parameter Mechanical Systems. *Energy Week '96 and the ETC&E Conference: Structural Dynamics Vibration and Buckling Symposium*, Book IV, Vol. III, Pages 290–300, Houston, Texas, January.
25. Barhorst, A. A. (1995). Modeling Contact/Impact in Hybrid Parameter Multiple Body Mechanical Systems—Extensions for Higher Order Continuum Models. *Time Varying Systems and Structures Symposium, ASME Conference on Mechanical Vibration and Noise*, Vol. 3, Part A, Pages 99–107, Boston, Massachusetts, September.
26. Daloglu, A., Barhorst, A. A., and Oler, J. W. (1995). Response of the Driver-Vehicle System to Cross-Wind Excitation. *ETC&E Conference: Structural Dynamics Vibration and Buckling Symposium*, PD-Vol. 70, Pages 11–16, Houston, Texas, January.
27. Barhorst, A. A. (1993). Systematic Closed Form Modeling of Hybrid Parameter Multiple Body Systems. *Proceedings of the ASME Winter Annual Meeting*, Paper # 93-WA/DSC-1, New Orleans, Louisiana, November.
28. Barhorst, A. A. (1993). Closed Form Modeling of Continuous Parameter Robotic Systems—Contact/Impact and Wave Propagation. *14th Biennial Conference on Mechanical Vibration and Noise*, DE-Vol. 57, Pages 39–47, Albuquerque, New Mexico, September 19–22.
29. Barhorst, A. A., and Everett, L. J. (1993). Contact/Impact in Hybrid Parameter Multiple Body Mechanical Systems. *ETC&E Conference: Dynamics and Vibrations Symposium*, PD-Vol. 52, Pages 27–35, Houston, Texas, January.
30. Barhorst, A. A., and Everett, L. J. (1992). A Methodology for Modeling Hybrid Parameter Multiple Body Systems. *ASME Symposium on Dynamics of Flexible Multibody Systems: Theory and Experiment*, DSC-Vol. 37, Pages 197–205, Anaheim, California, November.
31. Barhorst, A. A., and Everett, L. J. (1992). Obtaining the Minimal Set of Hybrid Parameter Differential Equations for Mechanisms. *ASME Design Engineering Technical Conference*, DE-Vol. 47, Pages 311–316, Phoenix, Arizona, September.

## Funded Research

1. Modeling of Elasto-Mechanical Phenomena Involved in the Motor-Driven Assembly of Nanomaterials. Funded by The Center for Integrated Nanotechnologies (CINT/DOE).

- June 1, 2008–September 1, 2009, Funds half time of CINT colleague and provides lab and user space at CINT/Sandia.
2. Cadaveric Knees, Fall 2006, Funded by TTU V. P. for Research, \$5,000.
  3. Elasto-dynamical modeling of collisions between cargo-carrying biomolecular shuttles. Funded by The Center for Integrated Nanotechnologies (CINT/DOE). September, 2006–January 15, 2007, Funds half time of CINT colleague and provides lab and user space at CINT/Sandia.
  4. Elasto-dynamical modeling of collisions between cargo-carrying biomolecular shuttles. Faculty Development Leave at Sandia National Labs. September, 2006–January 15, 2007. Funded by Texas Tech University, \$75,184.
  5. Analysis of Biomechanics of Failure in the Human Anterior Cruciate Ligament Based on Gender–A Cadaveric Study, with J. Hashemi (PI) and M. Zumwalt. Funded by Texas Tech University Interdisciplinary Seed Grant, 2005, \$17,500.
  6. Integrating Robotics into Physiological Biomechanical Testing–Dynamic Multiaxis Loading of Cadaveric Joints. Funded by the Texas Tech College of Engineering, 2005, \$15,600.
  7. NASA EDU Plant Growth Chamber, Engineering, James Smith, PI. Funded by NASA, 2003-2004, (Barhorst fraction: ~\$58,000).
  8. Development of a Tumbleweed Inspired Instrument Carrier for Mars. Barhorst, A. A. and James, D. L., Funded by the Texas Space Grant Consortium and NASA LaRC, 2003, \$49,000.
  9. NASA EDU Plant Growth Chamber, Engineering, James Smith, PI. Funded by NASA, 2002-2003, (Barhorst fraction: ~\$58,000).
  10. A Dynamic Model of Avian Kinesis, Barhorst, A. A., Chatterjee, S., and Schovanec, L. Interdisciplinary seed grant, Texas Tech University, 2002–2003, \$18,673.
  11. Predictive Dynamic Simulation of Structures with Non-Smooth Nonlinearities, Burton, T. D., and Barhorst, A. A. Funded by AFOSR, 2002–2004, \$251,975.
  12. NASA EDU Plant Growth Chamber, Engineering, James Smith, PI. Funded by NASA, 2001-2002, (Barhorst fraction: ~\$55,000).
  13. NASA EDU Plant Growth Chamber, Engineering, James Smith, PI. Funded by NASA, 2000-2001, (Barhorst fraction: ~\$53,000).
  14. Texas Space Grant Consortium (Undergraduate design/research), Barhorst, TTU Liaison. Funded by NASA via The University of Texas, 1999–2003, \$3,000/yr.
  15. High Fidelity Models for Complex Hybrid Parameter Mechanical Systems. Funded by The Texas Tech Center for Applied Automation and Research (CFAR), 1998–99, \$10,500.
  16. Special Nuclear Material Handling, Simulation and Robotics Design, with TTU, TAMU, and UTAr Robotics Groups. Funded by the Amarillo National Resource Center for Plutonium, January 16, 1998–January 15, 1999, \$300,000, (TTU fraction: \$55,000).

17. A Research Program in Automation, Robotics, and Tele-Operation, with TTU, TAMU, UTAr, and UTA Robotics Groups. Funded by the Amarillo National Resource Center for Plutonium, January 16, 1997–January 15, 1998, \$250,000, (Barhorst, A. A., PI, TTU: \$100,000)
18. Modeling Fluid-Structure Interaction–Slender Long-Reach Robots Conveying Fluid. Continuation. Funded by The Texas Tech Center for Applied Automation and Research (CFAR), 1997–98, \$8,500.
19. A Research Program in Automation, Robotics, and Tele-Operation. Matching funding by CFAR, 1997, \$7,500.
20. Modeling Fluid-Structure Interaction–Slender Long-Reach Robots Conveying Fluid. Funded by The Texas Tech Center for Applied Automation and Research (CFAR), 1996–97, \$9,000.
21. Generalized Modeling of Fluid/Structure Interaction. Funded by Sandia National Labs, Summer, 1996, \$11,360.
22. Robotics, Automation, and Tele-Operation Program for Safe Handling and Long-Term Storage of Nuclear Components, with TTU, TAMU, UTAr, and UTA Robotics Groups. Funded by the Amarillo National Resource Center for Plutonium, June 1996–January 15, 1997, \$483,593, (Barhorst, A. A., PI, TTU: \$214,500).
23. Application of Wavelet Analysis for the Evaluation of Internal Damage in Composite Wind Turbine Blades via Acoustic Emission Techniques, Barhorst, A. A. and Hashemi, J. Continuation, funded by The Wind Engineering Center, State of Texas, 1995–96, \$15,000.
24. Multi-Body Dynamic Modeling, Burton, T. D. and Barhorst, A. A. Funded by The Texas Tech Center for Applied Automation and Research (CFAR), 1995–96, \$6,000.
25. Continuation of Modeling and Experimental Verification of Contact/Impact Dynamics in Robotic and Structural Systems–A Dual Use Study. Funded by CFAR, 1995–96, \$4,000.
26. Robotics, Automation, and Tele-Operation Program for Safe Handling and Long-Term Storage of Nuclear Components. Matching funding by CFAR, 1995–96, \$20,000.
27. Generalized Modeling of Fluid/Structure Interaction. Funded by Sandia National Labs, Fall, 1995, \$15,000.
28. Robotics, Automation, and Tele-Operation Program for Safe Handling and Long-Term Storage of Nuclear Components, with TTU, TAMU, UTAr, and UTA Robotics Groups. Funded by the Amarillo National Resource Center for Plutonium, 1995–96, \$400,000, (Barhorst, A. A., PI, TTU: \$190,000).
29. Spatial Model for Fluid Sloshing. Funded by Sandia National Labs, Summer, 1995, \$15,000.
30. Increasing Cooling-Tower Fan Efficiency and Life Through Advanced Vibration Monitoring, Barhorst, A. A. and Ertas, A. Funded by The Texas Tech Center for Energy Research, 1995, \$2400.

31. Application of Wavelet Analysis for the Evaluation of Internal Damage in Composite Wind Turbine Blades via Acoustic Emission Techniques, Barhorst, A. A. and Hashemi, J. Continuation, funded by The Wind Engineering Center, State of Texas, 1994–95, \$28,000.
32. Modeling and Experimental Verification of Contact/Impact Dynamics in Robotic and Structural Systems—A Dual Use Study. Funded by CFAR, 1994–95, \$11,300.
33. Rapid Prototyping and Flexible Manufacturing of Advanced Ceramic Matrix Composite Parts, Hashemi, J., et al., and Barhorst, A. A. Funded by CFAR, 1994–95, \$12,600.
34. Application of Wavelet Analysis for the Evaluation of Internal Damage in Composite Wind Turbine Blades via Acoustic Emission Techniques, Barhorst, A. A. and Hashemi, J. Funded by The Wind Engineering Center, State of Texas, Summer 1994, \$18,000.
35. Dish Stirling Solar Concentrator Design for Distributed Wind and Vibration Loads, Dunn, J. R. and Barhorst, A. A. Funded by Cummins Power Generation Company, Inc., 1994–95, \$32,000.
36. Dish Stirling Solar Concentrator Design for Distributed Wind and Vibration Loads, Dunn, J. R. and Barhorst, A. A. Funded by The center for Energy Research, 1993–94, \$34,200.
37. Modeling Analysis, and Verification of Contact/Impact Dynamics in Hybrid Parameter Robotic Manipulators. Funded by The Texas Tech College of Engineering Line Item Source, 1992–93, \$20,200.

### **Invited Presentations**

1. Ideas for Continued Development of the Department of Mechanical Engineering, University of Louisiana at Lafayette, February, 2009.
2. Low Order Models of Ubiquitous Bolted Joint Elastic Structures and Other Topics of Research, Texas A&M University, March, 2007.
3. Model Based Simulation Via Hybrid Parameter Projection Methods Results and Directions, Texas Tech University, Mathematics and Statistics Department, October, 2003.
4. Model Based Simulation Via Hybrid Parameter Projection Methods Results and Directions, Los Alamos National Laboratory, August, 2003.
5. Dynamics from a Hybrid Parameter Projection Method Perspective—Results and Directions, The University of Colorado at Colorado Springs, Colorado Springs, May, 2002.
6. Dynamics from a Hybrid Parameter Projection Method Perspective, Dynacs, Inc., Houston, April, 2000.
7. Hybrid Parameter Projection Methods as a Basis for Model Based Simulation, Presented at Texas Tech University, Electrical Engineering, April, 2000.
8. Overview of Recent Results in Hybrid Parameter System Modeling. Presented at Sandia National Labs, January, 2000.
9. Overview of Recent Research in Hybrid Parameter System Modeling for Control. Presented at the Army Tank Command, August, 1998.

10. Overview of Recent Research in Hybrid Parameter System Modeling for Control–and–Some Results in Wavelet Based NDE of Composite Materials. Presented at the Illinois Institute of Technology, Chicago, April, 1998.
11. Hybrid Parameter Multiple Body System Modeling, Including Fluid Interaction–Towards a 3D Model of a Robot Carrying a Container of Fluid. Presented at Sandia National Labs, May, 1995.
12. Systematic Modeling of Complex Hybrid Parameter Mechanical Systems–Extensions for Contact/Impact and an Example. Presented at Sandia National Labs, November, 1993.
13. Modeling Hybrid Parameter Mechanical Systems, Presented at The University of Miami, Miami, April, 1992.

### Technical Reports

1. Predictive Dynamic Simulation of Structures with Non-Smooth Nonlinearities, with T. D. Burton. Extended Abstracts of Research Results. Submitted to AFOSR, 2003-2005.
2. Annual progress reports for EDU Plant Growth Chamber. Submitted to NASA, 2000–2004.
3. Quarterly progress reports for EDU Plant Growth Chamber. Submitted to NASA, September, 2000–2004.
4. Annual Research Reports. Submitted to The Amarillo National Resource Center for Plutonium, 1995–1998.
5. Final Research Report. Submitted to The Amarillo National Resource Center for Plutonium, January, 1999.
6. Quarterly Research Reports. Submitted to The Amarillo National Resource Center for Plutonium, July, 1995–April, 1998.
7. Modeling and Experimental Verification of Contact/Impact Dynamics in Robotic and Structural Systems–A Dual Use Study. Submitted to CFAR, August, 1995.
8. Application of Wavelet Analysis for the Evaluation of Internal Damage in Composite Wind Turbine Blades via Acoustic Emission Techniques. Barhorst, A. A. and Hashemi, J. Submitted to The Wind Engineering Research Center, Texas Tech University, Lubbock, Texas, August, 1995.
9. Wind Load Analysis and Vibration Absorber Design for a Solar Energy Collector Dish. Omoridion, P. and Barhorst, A. A. Submitted to: Cummins Power Generation, Inc. Abilene, Texas, December 1994.
10. Dish-Stirling Solar Concentrator Design for Distributed Wind and Vibration Loads. Dunn, J. R. and Barhorst, A. A. Submitted to: The Center for Energy Research, Texas Tech University, Lubbock, Texas, September, 1994.
11. Certification of A Hybrid Parameter Model of the Fully Flexible Shuttle Remote Manipulator System. Submitted to: Structures and Mechanics Division, Loads and Structural Dynamics Branch, NASA, Johnson Space Center, Houston, Texas, August 9, 1994.

12. Application of Wavelet Analysis for the Evaluation of Internal Damage in Composite Wind Turbine Blades via Acoustic Emission Techniques. Barhorst, A. A. and Hashemi, J. Submitted to The Wind Engineering Research Center, Texas Tech University, Lubbock, Texas, September 7, 1994.
13. Modeling, Analysis, and Verification Contact/Impact Dynamics in Hybrid Parameter Robotic Manipulators. Submitted to: College of Engineering, Texas Tech University, Lubbock, Texas, September 15, 1993.
14. Modeling The Shuttle Remote Manipulator System—Another Flexible Model. Submitted to: Structures and Mechanics Division, Loads and Structural Dynamics Branch, NASA, Johnson Space Center, Houston, Texas, August 13, 1993.
15. Understanding and Reducing Machine Errors. Submitted to: Industrial sponsors of the Program for Automation in Manufacturing (PAM) consortium. Texas A&M University, College Station, Texas, February 7, 1991.
16. Calibration of Manipulators Subject to Gravity Loads. Submitted to: Industrial sponsors of the Program for Automation in Manufacturing (PAM) consortium. Texas A&M University, College Station, Texas, December 9, 1988.
17. Results for MRMS/CETF Station Control Studies, Flight #8. Submitted to: Avionics Department, NASA, Johnson Space Center, Houston, Texas, January 15, 1988.
18. Math Model for MRMS/CETF Station Control Studies, Flight #8. Submitted to: Avionics Department, NASA, Johnson Space Center, Houston, Texas, September 15, 1987.

### **Technical Presentations**

1. Predictive Dynamic Simulation of Structures with Non-Smooth Nonlinearities, with T. D. Burton. Presented at the AFOSR Researchers Conference, Santa Fe, NM, August, 2005.
2. Predictive Dynamic Simulation of Structures with Non-Smooth Nonlinearities. Presented at the AFOSR Researchers Conference, Winter Green, VA, August, 2004.
3. Texas Tech University/NASA EDU Project: Engineering Progress Report. Presented to NASA research monitor, Texas Tech University, February, 2001.
4. Progress Report Presentations: Robotics, Automation, and Tele-Operation Program for Safe Handling and Long-Term Storage of Nuclear Components. Presented at the ANRCP, Amarillo, Texas, September, 1995, and November, 1996.
5. Robotics, Automation, and Tele-Operation Program for Safe Handling and Long-Term Storage of Nuclear Components. Presented to the ANRCP/Pantex on TTU Campus, July, 1995.
6. Systematic Modeling of Complex Hybrid Parameter Mechanical Systems—Another Look at Shuttle RMS. Presented to: Structures and Mechanics Division, NASA, Johnson Space Center, Houston, Texas, August 6, 1993.
7. Understanding and Reducing Machine Errors, Biannual Progress. Presented to: Industrial sponsors of the Program for Automation in Manufacturing (PAM) consortium. Texas A&M University, College Station, Texas, February 7, 1991.

8. Calibration of Manipulators Subject to Gravity Loads, Annual Progress. Presented to: Industrial sponsors of the Program for Automation in Manufacturing (PAM) consortium. Texas A&M University, College Station, Texas, December 9, 1988.
9. Disturbance Effects of the Movable Remote Manipulator System on the Control Moment Gyros of the Critical Evaluation Task Force Flight #8. Presented to: Avionics Department, NASA, Johnson Space Center, Houston, Texas, January 15, 1988.

### **Other Research Proposals in Review or Unfunded**

1. New exploration in the mechanisms of eye tissue injury in abusive head trauma using engineering models. Kasemsri, T; Barhorst, A. A.; and Mitchell, K. Joint TTU/TTUHSC proposal. In review at NIH, 2011–2012, \$383,405.
2. Biomolecular Motors as Nanofluidic Transporters in CB Smart Dust Sensors. Bachand, G. D.; Bachand, M.; Liu H.; Barhorst, A. A. Joint Sandia NL/TTU. White paper in review Defense Threat Reduction Agency, 2011-2012.
3. Modeling of Elasto-Mechanical Phenomena Involved in the Motor-Driven Assembly of Nanomaterials. Barhorst, A. A. In review at The Center for Integrated Nanotechnologies SNL/LANL, 2011-2012, CINT Users Fellowship.
4. Design Tool Development: Utilizing Elasto-Mechanical Phenomena in the Molecular Motor-Driven Assembly of Nanoscale Devices. Barhorst, A. A. Submitted to the NSF, 2010–2013, \$256,419.
5. Physical Simulation of Tornado-Like Vortices with Fluid-Structure Modeling, James, D. L and Barhorst, A. A. Submitted to the NSF, 2010–2013, \$350,239.
6. Low Cost Tumbleweed Inspired Sensor System. Barhorst, A. A. and Ahmed, S. (TAMUQ). Submitted to The Qatar National Research Fund, 2009–2012, \$1,049,499 (TTU: 35%).
7. Modeling Fluid-Structure Interaction via Projection Based Variational Principles. Barhorst, A. A. and Davis, M (TAMUQ). Submitted to The Qatar National Research Fund, 2009–2012, \$986,562 (TTU: 35%).
8. Low Order Models of Clearance Nonlinearities in Elastic Structures and Machines. Barhorst, A. A. and Masudi, H. (TAMUQ). Submitted to the Qatar National Research Fund, 2009–2012, \$1,049,860 (TTU: 35%).
9. Modeling of Elasto-Mechanical Phenomena Involved in the Motor-Driven Assembly of Nanomaterials. Barhorst, A. A. Submitted to the NSF, 2009-2012, \$264,117.
10. Dynamics - A Transformative Technique. Barhorst, A. A. Submitted to The NSF, 2009, \$78,996.
11. Modeling Fluid-Structure Interaction via Projection Based Variational Principles. Barhorst, A. A. and James, D. L. Submitted to the Qatar National Research Fund, 2008–2010, \$491,826.
12. Low Order Models of Clearance Nonlinearities in Elastic Structures and Machines. Barhorst, A. A. Submitted to the Qatar National Research Fund, 2008–2010, \$453,665.

13. Elasto-dynamical modeling of collisions between cargo-carrying biomolecular shuttles. Barhorst, A. A. Submitted to The NSF, 2007–2010, \$281,282.
14. Three Dimensional Integration of Cranial Kinesis and Neuroanatomy in Birds, Chatterjee, S.; Barhorst, A. A.; and Schovanec, L. Submitted to The NSF, 2007–2010, \$316,784.
15. Damaged Parameter Identification of Non-linear Structures Using Polynomial Interpolated Taylor Series. Barhorst, A. A. and Wong, C. N. Submitted to The NSF, 2006–2008, \$182,158.
16. Utilizing Pseudo-coordinates and Instantly Applied Nonholonomic Constraints to Model Multi-point Frictional Contact in Elastic Joints with Clearance. Barhorst, A. A. Submitted to The AFOSR, 2006–2009, \$299,994.
17. Elasto-dynamical modeling of collisions between cargo-carrying biomolecular shuttles. Barhorst, A. A. Submitted to The NSF, 2006–2009, \$257,605.
18. Bantam Tumbleweeds—A Customizable Sensor System to Engage Folks in Martian Exploration Yet Performing Real Science. Barhorst, A. A. Submitted to NASA Institute for Advanced Concepts, 2007, \$75,000.
19. Damaged Parameter Identification of Non-linear Structures Using Polynomial Interpolated Taylor Series. Barhorst, A. A. and Wong, C. N. Submitted to The NSF, 2005–2008, \$291,792.
20. Implementation of a Unified Hybrid-Parameter Approach to Modeling Mechanical Systems. Barhorst, A. A. Submitted to The Army Research Office, 2005–08, \$308,159.
21. An Integrated Three-Dimensional Biomechanical Model of Avian Skull Kinesis, Chatterjee, S.; Barhorst, A. A.; and Schovanec, L. Submitted to The NSF, 2004–2007, \$329,259.
22. Structural Dynamic Simulation of Complex Nonlinear Structures with Contact, Burton, T. D., and Barhorst, A. A. Submitted to The NSF, 2003–2005, \$206,497.
23. QEIB: An Integrated Three-Dimensional Biomechanical Model of Avian Skull Kinesis, Chatterjee, S.; Barhorst; A. A., Schovanec, L. Submitted to The NSF, 2003–2006, \$350,227.
24. Theoretical, Numerical, and Experimental Analysis of Flutter and Flutter Control in Aircraft Wings, Shubov, M. (PI); Barhorst, A.; Stearman, R.; and Burton, T. Submitted to The NSF FRG Program, 2003–2005, \$784,420.
25. Tumbleweed Inspired Sensors Platforms for Martian Exploration, Barhorst, A. A., et al. Submitted to NASA Mars Scout Mission of Opportunity Program, 2003–2008, \$24,641,000.
26. Gender Effects on Anterior Cruciate Ligament Mechanics, NIH/SCOR program, J. Hashemi (PI), A. Barhorst, J. Slauterbeck, H. Mansouri. Submitted to NIH, 2003–2008, \$1,421,985.
27. A Hybrid Parameter Approach to Human Movement Systems, Schovanec, L., and Barhorst A. A. Submitted to the Texas ARP, 2002–2003, \$99,857.
28. Implementing Degrees of Hybridness in Model Based Simulation, Barhorst, A. A., and Burton, T. D. Submitted to The NSF, 2001–03, \$266,539.

29. Predictive Dynamic Simulation of Structures with Non-Smooth Nonlinearities, Burton, T. D., and Barhorst, A. A. Submitted to The NSF, 2001–03, \$363,695.
30. A Study on the Feasibility of Vibration Measurements for Damage Identification in Bridges. Burton, T. D., and Barhorst, A. A. Submitted to The TxDOT, 2001–03, \$324,049.
31. Learning and Control of Physiological and Biomechanical Systems, Schovanec, L. (PI); Barhorst, A.; et al. Submitted to The NSF IGERT Program, 2001–2005, \$2,506,680.
32. Novel, Open, and Scalable Model Based Simulation of Mechanical and Structural Systems, Barhorst A. A., and Burton, T. D. Submitted to The NSF, 2000–01, \$149,941.
33. Efficacious Model Based Simulation of Fluid-Structure Interaction, Barhorst A. A., and James, D. L. Submitted to The NSF, 2000–02, \$222,643.
34. Nonlinear Flexible Multibody-Fluid Systems. Burton, T. D., and Barhorst, A. A. Submitted to The Army Research Office, 2000–02, \$235,112.
35. High-Speed/High-Fidelity/Low-Cost Models of Fluid-Structure Interaction. Barhorst, A. A.. Submitted to The Texas ARP, 1999–2001, \$120,600.
36. Experimental Verification of Discrete Wavelet Based AE Analysis of Failing FR Composites. Barhorst, A. A., and Hashemi, J. Submitted to The Texas ATP, 1999–2001, \$163,600.
37. Explicit Models of Fluid Interaction with Articulated Elastic Structures—Models for Control. Barhorst, A. A. Submitted to The Texas ATP, 1997–99, \$104,500.
38. Discrete Wavelet Analysis of AE Signals From Failing CFR Composites—Experimental Verification. Barhorst, A. A., and Hashemi, J. Submitted to The Texas ATP, 1997–99, \$116,800.
39. Acquisition of Research Instrumentation to Support Laser-Assisted Machining of Ceramics. Hashemi, J., Barhorst, A. A., et al. Submitted to The NSF, 1995–98, \$120,000.
40. Application of Wavelet Analysis to Evaluation of Internal Damage in Composite Materials Through Acoustic Emission Techniques Barhorst, A. A. and Hashemi, J. Submitted to The Naval Surface Warfare Center, 1995–97, \$120,000.
41. Identification of Composite Material Failure Modes Via Wavelet Based Acoustic Emission Analysis. Submitted to The Texas ARP, 1995–97, \$77,274.
42. Generalized Modeling Algorithms for Flexible Robotic Manipulators with Fluid Interaction. Submitted to The Texas ATP, 1995–97, \$83,120.
43. Modeling and Experimental Verification of Non-Linear Contact and Impact Motion in Flexible Manipulators, Barhorst, A. A. and Ertas, A. A. Submitted to The NSF unsolicited, 1995–98, \$225,766.
44. Dynamic Structural Analysis—Dish Stirling Solar/Electric Generator. Barhorst, A. A. and Dunn, J. R. Submitted to CER, 1994–95, \$40,000.

45. Acquisition of Research Instrumentation to Support a Regional Center for Laser-Assisted Machining of Ceramics,” Hashemi, J., Barhorst, A. A., et al. Submitted to DURIP, 1994–97, \$322,675.
46. Acquisition of Research Instrumentation to Support a Regional Center for Laser-Assisted Machining of Ceramics. Hashemi, J., Barhorst, A. A., et al. Submitted to the NSF Infrastructure Program, 1994–97, \$322,675.
47. Characterization of Viscoelastic Behavior of Energy Absorbing Polymeric Padding at High Strain Rates. Hashemi, J., Barhorst, A. A., Tock, R. Submitted to CER, 1994–95, \$22,500.
48. Increasing the Fidelity of Full Motion Regime Flexible Robot Models for Use in Off-Line Programing Schemes. Submitted to the NSF unsolicited, 1994–98 \$290,798.
49. Modeling and Experimental Verification of Non-Linear Contact and Impact Motion in Flexible Manipulators. Submitted to The NSF unsolicited, 1994–97, \$245,095.
50. Modeling and Experimental Verification of Contact/Impact Dynamics in Robotic and Structural Systems–A Dual Use Study. Submitted to NASA unsolicited, 1994–95, \$20,000.
51. Virtual Reality: Engineering Opportunities. Cardenas-Garcia, J. F., et al., and Barhorst, A. A. Submitted to CFAR, 1994–95, \$13,000.
52. Modeling and Experimental Verification of Contact/Impact Dynamics in Robotic and Structural Systems–A Dual Use Study. Submitted to NASA JSC Summer Faculty Fellows Director’s Grant Program, 1994–95, \$15,000.
53. Understanding Contact/Impact Dynamics in Hybrid Parameter Robotic Manipulators–The Next Step–Design Parameterization. Submitted to CFAR, 1993–94, \$40,000.
54. Dish-Stirling Solar Concentrator Design for Distributed Wind & Vibration Loads. Dunn, J. R. and Barhorst, A. A. Submitted to The Texas ATP, 1993–95, \$155,380.
55. Understanding Contact/Impact in Robotic Manipulators. Submitted to The Texas ARP, 1993–95, \$121,000.
56. NSF NYI Application, 1993.
57. Modeling, Analysis, and Verification of Contact/Impact Dynamics in Hybrid Parameter Robotic or Structural Systems. Submitted to The NSF RIA, 1993–96, \$100,000.
58. Advancing Intelligent Control in Manufacturing Systems. Marcy, W., et al., and Barhorst, A. A. Submitted to The NSF Intelligent Control RFP, January 1993–December 1995, \$574,435.
59. Modeling, Analysis, and Verification of Contact/Impact Dynamics in Hybrid Parameter Robotic or Structural Systems. Submitted to The NSF RIA, 1992–95, \$100,000.
60. Discovering Robust Solution Schemes for Minimal EOM Formulation for Hybrid Parameter Mechanisms. Submitted to TTU Graduate School Summer Research Program, 1993, \$800.

61. Modeling, Analysis, and Verification of Contact/Impact Dynamics in Hybrid Parameter Robotic or Structural Systems. Submitted to NASA unsolicited, January 1993, \$295,257.
62. Characterizing Space Station Freedom Solar Array Dynamic Whip. Submitted to NASA JSC Summer Faculty Fellows Director's Grant Program, 1993-94, \$15,000.
63. NSF Graduate Research Traineeships, Anderson, E. E., Barhorst, A. A., et al., 1992-93, \$150,000.
64. Modeling, Analysis, and Verification of Contact/Impact Dynamics in Hybrid Parameter Robotic or Structural Systems. Submitted to The Engineering Foundation RIA, 1992-93, \$23,000.
65. Modeling, Analysis, Verification, and Visualization of Contact/Impact Dynamics in Hybrid Parameter Robotic Manipulators. Barhorst, A. A. and Li, H. Submitted to TTU COE line item source, 1991-93, \$86,872.
66. Modeling, Analysis, and Verification of Contact/Impact Dynamics in Hybrid Parameter Robotic Manipulators. Submitted to The Texas ARP, 1991-93, \$86,872.
67. Modeling, Analysis, and Verification of Contact/Impact Dynamics in Hybrid Parameter Robotic or Structural Systems. Submitted to The Engineering Foundation, Fall 1991, \$23,000.

### **Courses Taught or Developed**

1. Undergraduate: Dynamics, System Modeling and Control, Control System Design, Introduction to Machine Design, Machine Component Design, Computer Aided Engineering, Mechanical Systems Lab, Vibrations, Statics, Individual Studies, Robotics.
2. Graduate: Engineering Analysis (PDEs), Vibrations, Advanced Structural Dynamics and Control, Graduate Analytical Dynamics, Robotics, Nonlinear Ordinary Differential Equations.

### **Research Laboratories Developed and Funded**

1. Mechanical Engineering Elasto-Dynamics Laboratory. Equipment: Air-bearing table, Flexible Manipulator test-bed, 10 Unix workstations on LAN. Assets valued at ~\$40,000.
2. Mechanical Engineering Robotics and Automation Laboratory. Equipment: Staubli RX 170 robot with force-torque sensor and vision system, Puma 762 and safety equipment, Trident Robotics PC-based controller for Puma, LynxOS real time system for control, SGI Indy workstation with Telegrip and Quest. Assets valued at ~\$170,000.
3. Mechanical Engineering Acoustic Emission Laboratory. Equipment: High speed acoustic signal acquisition equipment, two channels. Assets valued at ~\$10,000.

### **Acquired Donations**

1. Sandia National Laboratory: Staubli RX 170 robot with force-torque sensor and vision system. Estimated value \$65,000.

2. Loren Cook Co: One 48 inch cooling tower fan, \$5,000.
3. Texas Instruments (via Texas A&M): One PUMA 762 robot, controller, and safety equipment. Estimated value is \$50,000.

### **Journal Article Reviewer**

1. *Journal of Dynamic Systems, Measurement, and Control.*
2. *Journal of Sound and Vibration.*
3. *Journal of Vibration and Acoustics.*
4. *Journal of Vibration and Control.*
5. *Journal of Applied Mechanics.*
6. *Journal of Mechanical Design.*
7. *Journal of Composite Materials.*
8. *Journal of Guidance, Control, and Dynamics.*
9. *Journal of Fluids Engineering.*
10. *Journal of Engineering Mechanics.*
11. *Journal of Computational and Nonlinear Dynamics.*
12. *International Journal for Numerical Methods in Engineering.*
13. *Engineering Fracture Mechanics.*
14. *Experimental Mechanics.*
15. *Shock and Vibration Journal.*
16. *AIAA Journal.*
17. *Nonlinear Dynamics.*
18. *Materials and Design.*
19. *Canadian Journal of Zoology.*
20. *Multidiscipline Modeling in Materials and Structures.*

### **Proposal Reviewer**

1. NSF 2008
2. DEPSCoR Alabama 2001, 2002.
3. ARL/ARO 2002, 2005.
4. U.S. Civilian Research and Development Foundation (CRDF), 2003, 2005.

### **Conference Paper Reviewer**

1. ASME, Vibrations, ETC&E, ESDA, WAM, DETC, and IMECE.
2. IEEE, CDC, Robotics.
3. ACC Conference.
4. AIAA Conference.

### **Conference Session Chair**

1. ASME, ETC&E: Co-Chair, 1994; Chair 1995; Chair 1996.
2. SES 1998, Session organizer: Dynamics and Control Symposium.

### **Conference Workshop Organizer**

1. *The Eleventh SDPS Transdisciplinary Conference on Integrated Systems, Design, & Process Science: Workshop on Transcultural Transdisciplinary Engineering Education and Practice.* Asia University Taichung, Tawain, June 4, 2008.

### **Professional Short Courses Organized**

1. *Rotordynamics of Turbomachinery.* Taught by Professor Dara Childs, TAMU. Given at TAMU at Qatar, Spring 2008.

### **Book Reviews**

1. Harper Collins.
2. MacMillan.
3. Taylor & Francis.
4. Cambridge University Press.

### **Other Service**

1. Outside Tenure and Promotion Referee: Jordan University of Science and Technology, Kansas State University, The University of Texas at El Paso.
2. Serve as departmental liaison to The Texas Space Grant Consortium. Directed several senior design projects in this role.
3. Department committees, including Graduate Affairs (chaired) and curriculum committees.
4. Department search committees: Chairperson search; Controls faculty search (chaired); Mechanics faculty 1 search; Mechanics faculty 2 search (chaired); High pressure mechanics faculty search (chaired); Bio-Mechanics faculty search, Controls faculty search; Dynamics faculty search (chaired).
5. Departmental thesis/dissertation committees.

6. Graduate School thesis committees.
7. College level tenure committee (2000/2001-2002/2003).
8. College of Engineering Strategic Planning Committee (1995-96).
9. Judge for the South Plains Regional Science Fair, 7 years.
10. Provided Mathematics review for FE exam, 1992–95.
11. Lubbock O. L. Slaton Jr. High B.E.S.T. Inc. robotics team consultant, 2001-2003.
12. Lubbock High School B.E.S.T. Inc. robotics team consultant, 2004, 2005.
13. Provided Robotics overview and Career Day Mechanical Engineering overview to Lubbock Frenship ISD students, 2000, 2002, 2004-2006.
14. Youth Baseball Coach/Manager, 3 years.
15. Lubbock Frenship Terra Vista Middle School B.E.S.T. Inc. robotics team consultant, 2010.