

# FRANCISCO CASTRO

**Teaching Professor, University of Colorado Boulder**

*University of Colorado Boulder and Colorado Mesa University*

*Engineering Partnership Programs*

Confluence Hall, 1410 Seventh Street, Grand Junction, CO 81501

castrof@colorado.edu 970-248-1564

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## EDUCATION

**University of Colorado Boulder**

*Ph.D. Mechanical Engineering*

**Boulder, CO**

December 2009

Thermo-Mechanical Behavior of Shape Memory Polymers

Advisor: Jerry H. Qi

**University of Colorado Denver**

*M.S. Mechanical Engineering*

**Denver, CO**

August 2003

Measurement of Upper Extremity Performance as a Function of the Seating System

Advisor: Ronald R. Rorrer

**Pontifical Catholic University of Peru**

*B.S. Mechanical Engineering*

**Lima, Peru**

June 1997

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## ACADEMIC AND PROFESSIONAL EXPERIENCE

**University of Colorado Boulder**

**Grand Junction, CO**

University of Colorado Boulder and Colorado Mesa University Engineering Partnership

**Teaching Professor**, Mechanical Engineering

Fall 2023 - Present

**Associate Teaching Professor**, Mechanical Engineering

Fall 2017 - 2023

**Assistant Teaching Professor**, Mechanical Engineering

Fall 2010 - 2017

Courses Taught:

- Thermodynamics (MCEN 3012)
- Circuits and Electronics (MCEN 3017)
- Computational Methods (MCEN 3030)
- Component Design (MCEN 3025/ENGR 325)
- Data Analysis and Design of Experiments (MCEN 3037)
- Dynamics (MCEN 3043/ENGR 343)
- System Dynamics (MCEN 4043)
- Mechanical Engineering Design Project I and II (MCEN 4045 & MCEN 4085)  
(These courses involve collaborating with local industry representatives)
- Introduction to Finite Element Analysis (MCEN 4173/5173)
- Vibrations (MCEN 4123/5123)
- Advanced Materials: Polymers (MCEN 4228)
- Capstone Laboratory Part 1 & 2 (ECEN 4610 & ECEN 4620)

Other Activities:

- Participation in ABET Accreditation: assignment collection and rubric preparation
- Management of Engineering Partnership Program website
- Organization of Recruitment Activities: presentations and campus tours
- Academic Advising of Mechanical Engineering undergraduate students
- Coordination of Course Scheduling
- Faculty Hiring Committee Member

**University of Colorado Boulder**

**Boulder, CO**

**Instructor**, Department of Mechanical Engineering / Full Time

Spring 2010

Courses Taught: Dynamics and Senior Mechanical Engineering Laboratory

## ACADEMIC AND PROFESSIONAL EXPERIENCE (Continued)

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| <b>University of Colorado Boulder</b><br><b>Graduate Research Assistant</b> , Dept. of Mechanical Engineering<br>Experimental and theoretical research: thermo-mechanical behavior of Shape Memory Polymers<br>Collaborative Research Work with Cornerstone Research Group, Dayton, OH | <b>Boulder, CO</b><br>2005-2009   |
| <b>University of Colorado Boulder</b><br><b>Teaching Assistant</b> , Dept. of Mechanical Engineering<br>Courses: Measurements Laboratory, Solid Mechanics, and Finite Element Analysis   | <b>Boulder, CO</b><br>2005-2008   |
| <b>University of Colorado Boulder</b><br><b>Tutor</b> , College of Engineering & App. Science: Computational Methods   | <b>Boulder, CO</b><br>Spring 2005 |
| <b>Pontifical Catholic University of Peru</b><br><b>Laboratory Assistant</b> , Department of Mechanical Engineering<br>Experiment implementation and equipment maintenance in the thermal sciences Laboratory  | <b>Lima, Peru</b><br>Fall 2004    |
| <b>University of Colorado Denver</b><br><b>Graduate Research Assistant</b> , Dept. of Mechanical Engineering<br>Evaluation of upper extremity performance on subjects with Multiple Sclerosis  | <b>Denver, CO</b><br>2000-2003    |
| <b>University of Colorado Denver</b><br><b>Teaching Assistant</b> , Mechanical Engineering<br>Engineering Graphics and Computer Aided Design   | <b>Denver, CO</b><br>Fall 2000    |
| <b>Pontifical Catholic University of Peru</b><br><b>Field Engineer</b> , Department of Mechanical Engineering<br>Evaluation of industrial thermal equipment  | <b>Lima, Peru</b><br>1998-2000    |
| <b>Pontifical Catholic University of Peru</b><br><b>Laboratory Instructor/Grader</b> , Department of Mechanical Engineering<br>Supervision of students in the thermal sciences Laboratory  | <b>Lima, Peru</b><br>1995-2000    |
| <b>Americana de Aviacion</b><br><b>Assistant Engineer</b> , Department of Engineering<br>Planning, performance and control of aircraft maintenance tasks   | <b>Lima, Peru</b><br>1997         |
| <b>E. Wong Supermarkets</b><br><b>Engineering Intern</b> , Department of Engineering<br>Maintenance and modification of refrigeration equipment  | <b>Lima, Peru</b><br>1996         |

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## RESEARCH INTEREST

- Engineering Education
  - Mechanical Behavior of Materials
  - Thermo-Mechanical Behavior of Shape Memory Polymers (SMP)
  - Mechanics of Reinforced SMP Composites
  - Finite Element Analysis
  - Mechanical Testing
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## TEACHING INTERESTS

- Mechanics of Solids, Dynamics & Component Design
- Mechanical Engineering Design Project & Mechanical Engineering Laboratory
- Computational Methods & Finite Element Analysis
- System Dynamics, Vibrations, Circuits and Electronics & Thermal Sciences

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## **PUBLICATIONS**

### **PEER-REVIEWED JOURNAL PUBLICATIONS**

1. K.K. Westbrook, P. H. Kao, F. Castro, Y. Ding, H.J. Qi, 2011. A 3D finite deformation constitutive model for amorphous shape memory polymers: A multi-branch modeling approach for nonequilibrium relaxation processes. *Mechanics of Materials*, 24: 853-869.
2. F. Castro, K.K. Westbrook, J. Hermiller, D.U. Ahn, Y. Ding, H.J. Qi, 2011. Time and temperature dependent recovery of epoxy-based shape memory polymers. *Journal of Engineering Materials and Technology*, v133: n 2, p 021025.
3. F. Castro, K.K. Westbrook, K.N. Long, R. Shandas, H.J. Qi, 2010. Effects of thermal rates on the thermomechanical behaviors of amorphous shape memory polymers. *Mechanics of Time-Dependent Materials*, 14: n 3, p 219-241.
4. K.K. Westbrook, F. Castro, K.N. Long, A.J. Slifka, H.J. Qi, 2010. Improved testing system for thermomechanical experiments on polymers using uniaxial compression equipment. *Polymer Testing*, 29: n 4, p 503-512.
5. T. D. Nguyen, H. J. Qi, F. Castro, K.N. Long, 2008. A thermoviscoelastic model for amorphous shape memory polymers: Incorporating structural and stress relaxation, *Journal of the Mechanics and Physics of Solids*, 56: 2792-2814.
6. H. J. Qi, T. D. Nguyen, F. Castro, C. Yakacki, R. Shandas, 2008. Finite deformation thermo-mechanical behavior of thermally induced shape memory polymers, *Journal of the Mechanics and Physics of Solids*, 56: 1730-1751.

### **CONFERENCE PRESENTATIONS**

1. F. Castro, H. J. Qi, C. R. Shandas, 2008, Thermo-Mechanical Behavior of Thermally Induced Shape Memory Polymers, Society of Engineering Science, Urbana-Champaign, IL, October 20th, 2008.
2. F. Castro, K. N. Long, H. J. Qi, M.L. Dunn, R. Shandas, 2008, Thermo-Mechanical Modeling of Thermally Induced Shape Memory Polymers, CU-Industry Advisory Council Meeting, Boulder, CO, May, 2nd, 2008.
3. F. Castro, H. J. Qi, C. Yakacki, R. Shandas, 2007, Temperature Rate Effects on Thermally Induced Shape Memory Polymers, Society of Engineering Science, College Station, TX, October 22nd, 2007.

### **CONFERENCE PROCEEDINGS**

1. F. Castro, K. Westbrook, J. Hermiller, D.U. Ahn, Y. Ding, H. J. Qi. Time dependent recovery of shape memory polymers. Conference Proceedings of the Society for Experimental Mechanics Series, v 3, p 307-312, 2011, Time Dependent Constitutive Behavior and Fracture/Failure Processes - Proceedings of the 2010 Annual Conference on Experimental and Applied Mechanics, Indianapolis, IN.
2. K. Westbrook, F. Castro, H. J. Qi. Temperature dependent recovery of shape memory polymers. International SAMPE Technical Conference, 2010 SAMPE Fall Technical Conference and Exhibition, Salt Lake City, UT.
3. F. Castro, H. J. Qi, J. Hermiller, E. Havens. Time dependent thermo-mechanical behavior of thermally induced shape memory polymers. Proceedings of SPIE - The International Society for Optical Engineering, v 7290, 2009, Industrial and Commercial Applications of Smart Structures Technologies 2009, San Diego, CA.
4. J. Hermiller, K. M. Cable, C. D. Hemmerlgarn, H. J. Qi, F. Castro. Thermal design methodology for attaching morphing components. Proceedings of SPIE - The International Society for Optical Engineering, v 7290, 2009, Industrial and Commercial Applications of Smart Structures

Technologies 2009, San Diego, CA.

5. H. J. Qi, F. Castro, J. Hermiller, E. Havens. Time dependent thermo-mechanical behavior of thermally induced shape memory polymers. Source: International SAMPE Symposium and Exhibition (Proceedings), v 54, 2009, SAMPE '09 Spring Symposium Conference Proceedings, Baltimore, MD.
  6. F. Castro, H. J. Qi. Investigation of thermo-mechanical behavior of shape memory polymers. Society for Experimental Mechanics - SEM Annual Conference and Exposition on Experimental and Applied Mechanics 2009, v 3, p. 1616-1620, 2009, Society for Experimental Mechanics - SEM Annual Conference and Exposition on Experimental and Applied Mechanics 2009, Albuquerque, NM.
  7. H. J. Qi, F. Castro, K. N. Long. Finite Element Simulations of Thermally Induced Shape Memory Polymers Based Applications, in Proceedings of NSF CMMI Grantee Conference, Knoxville, TN.
  8. H. J. Qi, F. Castro, J. Hermiller, E. Havens. On the development of constitutive models of finite deformation behavior of shape memory polymers. International SAMPE Technical Conference, 2007, 2007 SAMPE Fall Technical Conference and Exhibition - From Art to Science: Advancing Materials and Process Engineering, Cincinnati, OH.
  9. H. J. Qi, M.L. Dunn, K. Long, F. Castro, R. Shandas, 2007. Thermomechanical Indentation of Shape Memory Polymers, in Behavior and Mechanics of Multifunctional and Composite Materials 2007, edited by M.J. Dapino, Proc. of SPIE v.6526, 652615, San Diego, CA.
  10. F. Castro, R. A. L. Rorrer, D. J. Blake, D. D. Scott, P. M. Kennedy, T. Hearty, S. G. Fitzgerald. Measurement of Upper Extremity Performance as a function of the Seating System: A Comparison on People with Multiple Sclerosis, in 26th RESNA Annual Conference Proceedings, June 2003, Atlanta, GA.
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## **AWARDS AND MEMBERSHIPS**

- Unconventional Energy Center at Colorado Mesa University Seed Grant: “Design and Fabrication of a Small-Scale Oilseed Processing System to Produce Feedstock for Diesel Biofuels”, December 2014, \$24,000. Proposal was directed by Dr. P. Cabot and Dr. G. Litus (Colorado State University, Western Colorado Research Center, Grand Junction)
  - CU-CMU Seed Grant, “Advanced Sensing of Air Pollution to Reduce Impacts of Oil and Gas Development”, March 2014, \$10,000. Proposal was directed by CU faculty: Jana Milford, Francisco Castro and Michael Hannigan.
  - CU Boulder Mechanical Engineering Outstanding Ph.D. Dissertation (Spring 2009)
  - Member of the American Society of Mechanical Engineers (ASME)
  - Member of the American Society for Engineering Association (ASEE)
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## **SKILLS**

### **Computational**

MATLAB, Simulink, LaTeX, Python, Abaqus, SolidWorks, LabVIEW, AutoCad, Pro-Mechanica, Fortran, and SPSS

### **Languages**

Fluent in English and Spanish