

# Frances M. Davis

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## EDUCATION

**Ph.D., Engineering Mechanics**, May 2013

Virginia Tech, Blacksburg, VA

*Dissertation:* Nonlinear viscoelastic behavior of ligaments and tendons: Models and experiments

**B.S., Engineering Science and Mechanics**, May 2006

Minor: Mathematics, Specialization: Biomechanics, GPA: 3.73/4.0

Virginia Tech, Blacksburg, VA

## PROFESSIONAL APPOINTMENTS

**Postdoctoral Fellow**, February 2015 - Present

University of Southampton, Engineering Sciences Unit

*Project:* Characterization of the high strain-rate behavior of polymers using impact tests

**Postdoctoral Fellow**, September 2013 - February 2015

École Nationale Supérieure des Mines Saint-Etienne

*Project:* Characterization of the heterogeneous material properties of thoracic aortic aneurysms

**Lecturer**, June 2013 - August 2013

Virginia Tech, Department of Engineering Science and Mechanics

**Summer Research Appointment**, June 2012 - August 2012

Argonne National Laboratory, Advanced Photon Source - Sectors 1 & 18

## FELLOWSHIPS

Leverhulme Early Career Fellow, March 2017 - March 2020

New Frontiers Fellow, March 2016 - Present

Whitaker Foundation International Postdoctoral Fellowship, Sept 2013 - Feb 2015

National Science Foundation Graduate Research Fellowship, June 2010 - May 2013

Ford Foundation Fellowship, August 2009 - May 2012

## PUBLICATIONS

F. Davis, Y. Luo, A. Duprey, S. Avril, J. Lu, “Local mechanical properties of human ascending thoracic aortic aneurysms”, *Journal of the Mechanical Behavior of Biomedical Materials*, 61, pp 235-249, 2016.

O. Trabelsi, F. Davis, A. Duprey, J.F. Rodriguez, A. Avril, “Patient specific stress and rupture analysis of ascending thoracic aneurysms”, *Journal of Biomechanics*, 48(10), pp 1836-1843, 2015.

F. Davis, Y. Luo, A. Duprey, S. Avril, J. Lu, “Pointwise characterization of the elastic properties of planar soft tissues: application to ascending thoracic aortic aneurysms”, *Biomechanics and Modeling in Mechanobiology*, 14(5), pp 967-978, 2015 .

T. Tan, F. Davis, J. Roberson, J. Massengill, D. Gruber, R. De Vita, “Histo-mechanical properties of the swine cardinal and uterosacral ligaments”, *Journal of the Mechanical Behavior of Biomedical Materials*, 42, pp 129 - 137, 2015.

F.M. Davis, R. De Vita, “A Three Dimensional Constitutive Relation for the Stress Relaxation Behavior of Articular Ligaments”, *Biomechanics and Modeling in Mechanobiology*, 13 (3), pp 653 - 663, 2014.

F.M. Davis, R. De Vita, “A Nonlinear Constitutive Model for Stress Relaxation in Ligaments and Tendons”, *Annals of Biomedical Engineering*, 40 (12), pp 2541-2550, 2012.

A. Small, T. Plaisted, M. Rogers, F. Davis, L. Sterner, “A Non-Halogenated Flame Retardant Additive for Pultrusion”, *Composites Research Journal*, 2, pp 15- 25, Spring 2008.

R.H. Plaut, F.M. Davis, “Sudden lateral asymmetry and torsional oscillations of section models of suspension bridges”, *Journal of Sound and Vibration*, 307, pp 894-905, August 2007.

### **Publications in Progress**

F.M. Davis, S. Dreuilhe, C. Sivoir, F. Pierron, “An assessment of two ultra high speed cameras for 2D full-field deformation measurements”

F.M. Davis, S. Dreuilhe, F.Pierron “A novel inertial impact test to quantify the high strain properties of metals”

### **CONFERENCE PROCEEDINGS**

F. Davis, F. Pierron, C. Sivoir, “Inertial impact tests on polymers for inverse parameter identification”, *Conference Proceedings of the Society for Experimental Mechanics Series*, Ch. Advanced Optical Methods in Experimental Mechanics, Vol. 3, pp. 187-190, from SEM Annual Conference 2016, (June 2016, Orlando, FL)

F. Davis, T. Tan, S. Nicewonder, R. De Vita, “Tensile Properties of the Swine Cardinal Ligament”, *Proceeding of ASME 2013 Summer Bioengineering Conference*, (June 2013, Sunriver, Oregon).

F. Davis, R. De Vita, “A Nonlinear Viscoelastic Model for the Relaxation Behavior of Tendon”, *Proceeding of ASME 2012 Summer Bioengineering Conference*, (June 2012, Puerto Rico).

Z. Guo, R. De Vita, F. Davis, “Investigation of Damage in Medial Collateral Ligaments”, *Proceeding of ASME 2011 Summer Bioengineering Conference*, (June 2011, Farmington, PA).

### **CONFERENCE PRESENTATIONS**

F.M. Davis, Y. Luo, S. Avril, J. Lu, “Pointwise identification of the elastic properties in thoracic aneurysm tissue”, *EuroMech Colloquium 560: Mechanics of Biological Membranes*, (February 2015, Ascona, Switzerland).

F.M. Davis, P. Badel, S. Avril, “Characterization of the structural mechanisms in thoracic aneurysm failure”, *International Symposium on Computer Methods in Biomechanics and Biomedical Engineering*, (October 2014, Amsterdam, Netherlands).

F.M. Davis, A. Romo, P. Badel, S. Avril, “Biomechanics of the ATAA: A local analysis using multiphoton microscopy, bulge inflation testing, and full field measurements”, *World Congress of Biomechanics*, (July 2014, Boston, MA).

F. M. Davis, R. De Vita, “Three-dimensional elastic and relaxation response of the medial collateral ligament”, *Biomedical Engineering Society Annual Meeting*, (October 2012, Atlanta, GA).

F. M. Davis, R. De Vita, “Application of a Nonlinear Viscoelastic Model to the Relaxation Behavior of Ligaments”, Biomedical Engineering Society Annual Meeting, (October 2011, Hartford, CT).

F. M. Davis, R. De Vita, “A Non-Linear Viscoelastic Model for the Relaxation of Tendon”, 48<sup>th</sup> Annual Technical Conference of the Society of Engineering Sciences, (October 2011, Chicago, IL).

F. M. Davis, R. De Vita, “A Constitutive Law for Characterizing the Response of Insect Trachea”, Ford Foundation Fellows Annual Meeting 2009, (October 2009, Irvine, CA).

F. M. Davis, R. De Vita, J. Socha, “A Constitutive Law for Characterizing the Response of Insect Trachea”, Joint ASCE-ASME-SES Conference on Mechanics of Materials, (June 2009, Blacksburg, VA)

## TEACHING AND ADVISING

University of Southampton

Engineering Mechanics, Statics II Module (Strength of Materials): Fall 2015, Fall 2016

Ecole des Mines de St. Etienne

Biomechanics - Supervised Course Project (M.S.): Spring 2014

Industrial and Natural Disasters - English Module (M.S.): Spring 2014

Virginia Tech

Statics: Summer 2013

Mechanical Behavior of Materials Laboratory: Fall 2008

### PhD Students:

Sarah Dreuilhe, Expected graduation: Dec 2016

Novel inertial tests for the inverse identification of elasto-plastic parameters of metals at high strain rates

Alexsandr Marek, Expected graduation: Dec 2018

Development of noise minimization techniques to aid the identification of anisotropic plasticity parameters

**Undergraduate Researchers:** Brian Lublow (Fall 2011 - Spring 2013), David Sloas (Summer 2014), Jason L’Hommel (Feb 2016 - July 2016)

## PROFESSIONAL ACTIVITIES

Reviewer for *Journal of Biomechanics*, *Journal of the Mechanical Behavior of Biomedical Materials*, *Strain*, ASME Summer Biomechanics Conference Student Paper Competition

Member, Society for Experimental Mechanics, 2016 - Present

Member, EuroMech, 2015 - Present

Member, American Society of Mechanical Engineering (Bioengineering Division), 2012 - Present

Member, Biomedical Engineering Society, 2011 - Present

Last updated: October 17, 2016