# John T. Foster

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## Education

Ph.D., Purdue University, 2009.

M.S. Mechanical Engineering, Texas Tech University, 2004.

B.S. Mechanical Engineering, *Cum Laude*, Texas Tech University, 2002.

## Professional Appointments

Assistant Professor, Department of Petroleum and Geosystems Engineering,
The University of Texas at Austin,
August 2014–Present.

Assistant Professor, Department of Mechanical Engineering,
The University of Texas at San Antonio,
August 2011–August 2014.

Senior Member of the Technical Staff, Terminal Ballistics Technology Department,
Sandia National Laboratories, Albuquerque, NM,
January 2006–August 2011.

Member of the Technical Staff, Terminal Ballistics Technology Department,
Sandia National Laboratories, Albuquerque, NM,
August 2004–January 2006.

## Awards & Honors

2013 Air Force Office of Scientific Research Young Investigator Award

2013 '40 Under 40' - San Antonio Business Journal

## Refereed Journal Articles

*Published*

1. J. O'Grady and J.T. Foster. Peridynamic beams: A non-ordinary state-based model. *International Journal of Solids and Structures*, 51(18):3177–3183, 2014.

2. M. Bessa, J.T. Foster, T. Belytschko, and W.K. Liu. A meshfree unification: Reproducing kernel peridynamics. *Computational Mechanics*, 53(6):1251–1264, 2014.

3. M.D Brothers, J.T. Foster, and H.R. Millwater. A comparison of different methods for calculating tangent-stiffness matrices in a massively parallel computational peridynamics code. *Computer Methods in Applied Mechanics and Engineering*, 279:247—267, September 2014.

4. R. Rahman and J.T. Foster. Bridging the length scales through nonlocal hierarchical multiscale modeling scheme. *Computational Material Science*, 92:401–415, September 2014.

5. R. Rahman, J.T. Foster, and A. Haque. A multiscale modeling scheme based on peridynamic theory. *International Journal of Multiscale Computational Engineering*, 12(3):223–248, 2014.

6. R. Rahman and J.T. Foster. Deformation mechanism of graphene in amorphous polyethylene: A molecular dynamics based study. *Computational Material Science*, 87:232–240, May 2014.

7. A. Katiyar, J.T. Foster, H. Ouchi, and M.M. Sharma. A peridynamic formulation of pressure driven convective fluid transport in porous media. *Journal of Computational Physics*, 261:209–229, March 2014.

8. E.E. Nishida, J.T. Foster, and P.E. Briseno. Constant-strain-rate testing of a G10 laminate composite through optimized Kolsky bar pulse shaping techniques. *Journal of Composite Materials*, 47(23):2895–2903, 2013.

9. R. Rahman, J.T. Foster, and A. Haque. Molecular dynamics simulation and characterization of graphene-cellulose nanocomposites. *The Journal of Physical Chemistry A*, 117(25):5344–5353, 2013.

10. J.T. Foster. Comments on the validity of test conditions in Kolsky bar experiments of elastic-brittle materials. *Experimental Mechanics*, 52(9):1559–1563, 2012.

11. J.T. Foster, D.J. Frew, M.J. Forrestal, E.E. Nishida, and W. Chen. Shock testing accelerometers with a Hopkinson pressure bar. *International Journal of Impact Engineering*, 46:56–61, August 2012.

12. J.T. Foster, S.A. Silling, and W. Chen. An energy based failure criterion for use with peridynamic states. *International Journal of Multiscale Computational Engineering*, 9(6):675–688, 2011.

13. J.T. Foster, W. Chen, and V.K. Luk. Dynamic crack initiation toughness of 4340 steel at constant loading rates. *Engineering Fracture Mechanics*, 78(6):1264 – 1276, 2011.

14. J.T. Foster, S.A. Silling, and W.W. Chen. Viscoplasticity using peridynamics. *International Journal for Numerical Methods in Engineering*, 81(10):1242–1258, 2010. ......................... .

15. J.T. Foster, A.A. Barhorst, C.N. Wong, and M.T. Bement. Modeling Loose Joints in Elastic Structures–Experimental Results and Validation. *Journal of Vibration and Control*, 15(4):549–565, 2009. ............................. .

### *Accepted*

1. J. O'Grady and J.T. Foster. Peridynamic plates and flat shells: A non-ordinary state-based model. *International Journal of Solids and Structures*, Accepted, 2014.

## Books Edited

### *In preparation*

1. The Handbook of Peridynamics. Edited by F. Bobaru, J.T. Foster, P. Guebelle, S.A. Silling. Taylor & Francis/CRC Press. Expected Publication: 2014

## Book Chapters

### *In preparation*

1. "Material Modeling". The Handbook of Peridynamics. Edited by F. Bobaru, J.T. Foster, P. Guebelle, S.A. Silling. Taylor & Francis/CRC Press. Expected Publication: 2014

2. "Modeling Diffusion Processes with Peridynamics". The Handbook of Peridynamics. Edited by F. Bobaru, J.T. Foster, P. Guebelle, S.A. Silling. Taylor & Francis/CRC Press. Expected Publication: 2014

## Conference Proceedings

1. J.R. York, J.T. Foster, E.E. Nishida, and B. Song. A novel torsional Kolksy bar for constant-strain-rate materials testing. In B. Song, D. Casem, and J. Kimberly, editors, *Dynamic Behavior of Materials, Volume 1*, Conference Proceedings of the Society for Experimental Mechanics Series. Springer New York, 2013. ...................................

2. J.T. Foster and E.E. Nishida. *A priori* pulse shaper design for constant-strain-rate tests of elastic-brittle materials. In V. Chalivendra, B. Song, and D. Casem, editors, *Dynamic Behavior of Materials, Volume 1*, Conference Proceedings of the Society for Experimental Mechanics Series, pages 379–386. Springer New York, 2013. ........................... .

3. J.T. Foster, D.J. Frew, M.J. Forrestal, E.E. Nishida, and W. Chen. Shock testing accelerometers with a Hopkinson pressure bar. *Experimental and Applied Mechanics, Volume 6*, pages 229–237, 2011. . . . . . . . . . . . . . . . . . . . . . . . . .

4. J.T. Foster, W. Chen, and V.K. Luk. Dynamic fracture initiation toughness of high strength steel alloys. In *DYMAT 2009-9th International Conference on the Mechanical and Physical Behaviour of Materials under Dynamic Loading*, volume 1, pages 407–412, 2009. . . . . . . . . . . . . . . . . . . . . . . . .

5. J.T. Foster, S.A. Silling, and W.W. Chen. State based peridynamic modeling of dynamic fracture. In *DYMAT 2009-9th International Conference on the Mechanical and Physical Behaviour of Materials under Dynamic Loading*, volume 2, pages 1529–1535, 2009. . . . . . . . . . . . . . . . . . . . . . .

6. J.T. Foster, S.A. Silling, and W.W. Chen. State based peridynamic modeling of dynamic fracture. In *SEM 2009 Conference on Experimental and Applied Mechanics*, number 33. SEM, 2009.

7. J.T. Foster, V.K. Luk, and W. Chen. Dynamic initiation fracture toughness of high strength steel alloys. In *Proceedings of the XIth International Congress and Exposition. Orlando, Florida Society for Experimental Mechanics Inc*, volume 77, 2008.

8. D.A. Dederman, D. Burnett, J.T. Foster, and J.A. Dykes. In Situ Penetration Testing of Darts with 16-Inch Mobile Gas Gun. In *Proceedings of 24th International Symposium on Ballistics*, number TB149, 2008.

9. J.G. Averett, J.D. Cargile, J.T. Foster, and V.K. Luk. Oblique Perforation of Unreinforced Concrete Targets: Experiments and Numerical Simulations. In *Limited Proceedings of 77th Shock and Vibration Conference*, 2007.

10. J.G. Averett, J.D. Cargile, J.T. Foster, and V.K. Luk. Projectile Deceleration Due to Perforation Through Layers of Unreinforced Concrete Targets. In *Limited Proceedings of 76th Shock and Vibration Conference*, number U-045. SAVIAC, 2006.

11. J.T. Foster, A.A. Barhorst, C.N. Wong, and M.T. Bement. Modeling and Experimental Verification of Frictional Contact-Impact in Loose Bolted Joint Elastic Structures. In *Proceedings of IDETC'05*, number DETC2005-85465. IDETC, 2005.

## Technical Reports

1. J.V. Cox, G.W. Wellman, J.M. Emery, J.T. Ostien, J.T. Foster, T.E. Cordova, T.B. Crenshaw, A. Mota, J.E. Bishop, S.A. Silling, D.J. Littlewood, J.W. Foulk III, K.J. Dowding, K. Dion, B.L. Boyce, J.H. Robbins, and B.W. Spencer. Ductile Failure X-prize. Technical Report SAND2011-6801, Sandia National Laboratories, 2012. . . . . . . . . . . . . . . . . . . .

2. E.E. Nishida, J.T. Foster, E.W. Klamerus, and D. Burnett. Dynamic behavior of shock isolation/ mitigation materials by kolsky bar experiments. Technical Report SAND2011-8266, Sandia National Laboratories, 2011.

3. J.T. Foster, A.E. Fortier, J.G. Averett, J.D. Cargile, V.K. Luk, and D.A. Dederman. Predictive Simulation for Perforation Through Layers of Unreinforced Concrete Targets. Technical Report SAND2008-113, Sandia National Laboratories, 2008.

4. J.T. Foster, A.J. Webb, A.E. Fortier, V.K. Luk, and D.A. Dederman. Penetration Code Study for Angle-of-Obliquity (AoO) Experiments into High-Strength Concrete Targets. Technical Report SAND2008-1162, Sandia National Laboratories, 2008.

5. P.D. Coleman, R.A. Bates, M.T. Buttram, S.B. Dron, J.T. Foster, R.J. Franco, C.O. Landron, G.M. Loubriel, J.E. Lucero, A. Mar, T.L. Martinez, F.E. Reyes, and B.J. Welch. Void Sensor for Penetrators. Technical Report SAND2007-6528, Sandia National Laboratories, 2007.

6. R.J. Fogler, J.W. Giron, J.A. Jacob, W.P. Wolfe, R.W. Greene, R.D. Tucker, A.E. Fortier, J.T. Foster, D.M. Van Zuiden, W.T. O'Rourke, H.D. Nguyen, E. Ollila, and J.R. Phelan. Guided miniature air-deliverable sensor dart. Technical Report SAND2007-6528, Sandia National Laboratories, 2007.

7. J.T. Foster and A.J. Webb. Penetration Simulations for Angle-of-Attack (AoA) Experiments into Low Strength Concrete Targets. SAND2007-5256, Sandia National Laboratories, 2007.

8. J.A. Dykes and J.T. Foster. Discrete-ULL 1-C Final Test Report. Technical Report SAND2007-4273, Sandia National Laboratories, 2007.

9. J.T. Foster. Scale Modeling of Earth Penetrators for In Situ Targets. Technical Report SAND2006-4273, Sandia National Laboratories, 2006.

# Technical Presentations

## *Conferences*

A nonlocal poroelastic approach to fluid driven fracture. (with J. York, A. Katiyar, H. Ouchi, M. Sharma). World Congress on Computational Mechanics XI. July 2014.

"Bridging the length scales by linking the atomistic model with coarser peridynamic models through molecular dynamics simulation of Polyethylene". (with R. Rahman). Mach Conference 2014. April 2014.

"Regularizing numerical simulations of strain-localization using a peridynamics-based plasticity formulation". (with Md.I. Kahn, D.J. Littlewood, and J.A. Mitchell). International Workshop on Computational Mechanics of Materials, IWCMM XXIII. October 2013

"A non-local formulation for fluid flow and mass transport in porous media based on peridynamic theory". (with A. Katiyar and M. Sharma). 12th US National Congress on Computational Mechanics. July 2013.

"A novel hierarchical multiscale modeling framework for polyethylene systems using Peridynamics and molecular dynamics". (with R. Rahman). 2013 Mach Conference, Annapolis, MD. April 2013.

"Two-Dimensional Semi-Analytic Solutions to the Linearized State-Based Peridynamic Equilibrium Equation". (with J.T. O'Grady). USACM Workshop on Nonlocal Damage and Failure: Peridynamics and other nonlocal methods. March 2013.

"A Peridynamics Based Hierarchical Multiscale Modeling Framework Between Continuum and Atomistic Scales". (with R. Rahman, A. Haque). USACM Workshop on Nonlocal Damage and Failure: Peridynamics and other nonlocal methods. March 2013.

"Lessons Learned in Modeling Ductile Failure with Peridynamics". (with D.J. Littlewood). USACM Workshop on Nonlocal Damage and Failure: Peridynamics and other nonlocal methods. March 2013.

"A Peridynamics Formulation of the Coupled Mechanics-Fluid Flow Problem". (with A. Katiyar, H. Ouchi, M.M. Sharma). USACM Workshop on Nonlocal Damage and Failure: Peridynamics and other nonlocal methods. March 2013.

"Implicit time integration of an ordinary state-based peridynamic plasticity model with isotropic hardening." (with D.J. Littlewood, J.A. Mitchell, M.L. Parks). ASME IMECE 2012. November 2012.

"Implicit time integration of an ordinary state-based peridynamic plasticity model with isotropic hardening." (with D.J. Littlewood, J.A. Mitchell, M.L. Parks). SiViRT Simulation and Vizualization Symposium. November 2012.

"Peridynamic Modeling of Localization in Ductile Metals." (with D.J. Littewood and B.L. Boyce) International Workshop on Computational Mechanics of Materials, IWCMM XXII. September 2012

"Viscoplasticity using peridynamics." (with S.A. Silling and W. Chen) 10th US National Congress on Computational Mechanics. July 2009.

## Student Delivered

"The Next Generation Model for Predicting the Growth of Complex Fracture Networks." (with J.R. York). 2014 Hydraulic Fracturing and Sand Control Joint Industry Program Technical Review. April 2014.

"A peridynamic model of diffusive fluid flow through a deformable media." (with J.R. York). 2013 SACNAS National Conference. October 2013.

"A complex-step method for tangent-stiffness calculation in a massively parallel computational peridynamics code." (with M.D. Brothers and H.R. Millwater). 12th US National Congress on Computational Mechanics. July 2013.

"Intragranular fracture and frictional effects in granular materials under pressure-shear loading." (with A.M. Peterson and T.J. Vogler) 18th Biennial Intl. Conference of the APS Topical Group on Shock Compression of Condensed Matter held in conjunction with the 24th Bien-

nial Intl. Conference of the Intl. Association for the Advancement of High Pressure Science and Technology (AIRAPT). July 2013.

## Invited Talks

"Nonlocal multiphysics for heterogeneous materials, anomalous diffusion, and fracture." ExxonMobile - Corporate Strategic Research, July 2014.

"A model for nonlocal diffusion and fluid-driven fracture." USACM/IUTAM Symposium on Connecting Multiscale Mechanics to Complex Material Design. Northwestern University. May 2014.

"Nonlocal multiphysics for heterogeneous materials, anomalous diffusion, and fracture." The University of Texas at Austin, Department of Petroleum & Geosystems Engineering. March 2014.

"Nonlocal multiphysics for heterogeneous materials, anomalous diffusion, and fracture." Northwestern University, Department of Mechanical Engineering. January 2014.

"Peridynamics as a unified theory for heterogenous media, anomalous porous flow, and fracture." The University of Texas at Austin, Department of Petroleum & Geosystems Engineering. October 2013.

"Unifying the mechanics of continuous and discontinuous media." Army Research Laboratory. February 2013.

"Unifying the mechanics of continuous and discontinuous media." The Johns Hopkins University, Center for Advanced Ceramics and Metallic Systems. July 2012.

"Unifying the mechanics of continuous and discontinuous media." Texas Tech University, Mechanical Engineering. April 2012.

"Hydraulic fracturing and its environmental impact: a short address of major public concerns." Presentation for the Center for Simulation, Visualization, and Real-Time Prediction participation in UTSA Earthweek 2012. April 2012.

"Unifying the mechanics of continuous and discontinuous media." 2011 International Workshop on Intensive Loading and its Effects. State Key Laboratory of Explosion Science and Technology, Beijing Institute of Technology. Beijing, China. December 2011.

"Peridynamic modeling of viscoplasticity and dynamic fracture." University of Nebraska, Engineering Mechanics. April 2010.

"Peridynamic modeling of viscoplasticity and dynamic fracture." University of New Mexico, Mechanical Engineering. February 2010.

## Poster

"Intragranular fracture and frictional effects in granular materials under pressure-shear loading." (with A.M. Peterson and T.J. Vogler) 18th Biennial Intl. Conference of the APS Topical Group on Shock Compression of Condensed Matter held in conjunction with the 24th Bien-

nial Intl. Conference of the Intl. Association for the Advancement of High Pressure Science and Technology (AIRAPT). July 2013.

# Grant Proposals

*Funded*

1. MURI Center for Material Failure Prediction Through Peridynamics. Air Force Office of Scientific Research, 2013-2018. ONRBAA12-020, *Co-PI* Total Award $7,500,000. Foster Award: $959,153.

2. Statistical coarse-graining of molecular dynamics into peridynamics. *Subaward* from Army Reasearch Laboratories Materials in Extreme Dynamic Environments Cooperative Research Agreement. The Johns Hopkins University, 2014. $101,306.

3. Predictive simulation of material failure using peridynamics-advanced constitutive modeling, verification, and validation. Air Force FY2013 Young Investigator Program. BAA-AFOSR-2012-0001, AFOSR, 2013-2015. *PI* $360,000.

4. Statistical coarse-graining of molecular dynamics into peridynamics. *Subaward* from Army Reasearch Laboratories Materials in Extreme Dynamic Environments Cooperative Research Agreement. The Johns Hopkins University, 2013. $97,471.

5. Peridynamic simulation of pressure-shear experiments on granular media. Sandia National Laboratories, 2013. *PI* $29,071

6. Statistical coarse-graining of molecular dynamics into peridynamics. *Subaward* from Army Reasearch Laboratories Materials in Extreme Dynamic Environments Cooperative Research Agreement. The Johns Hopkins University, 2012. $91,125.

7. Fracture Design, Placement And Sequencing In Horizontal Wells. Joint proposal with The University of Texas at Austin in response to solicitation number DE-FOA-0000724. DOE, 2012-2015. *co-PI* Total Award: $1,592,451, Foster Award: $275,250.

8. Application of Peridynamics to Hydraulic Fracture Modeling. The University of Texas at San Antonio – Office of the Vice President for Research, 2012. *PI* $18,927.

9. Peridynamic Simulation of Granular Materials Undergoing Shock Compression. Sandia National Laboratories, 2012. *PI* $32,597

10. Sandia X-Prize Necking Challenge. Sandia National Laboratories, 2012. *PI* $44,700.

*Pending*

1. DTRA Young Investigator Program: Multiscale peridynamic simulation of geomaterials under impact loading. Defense Threat Reduction Agency, 2014-2016. *PI* Reqesting: $200,000.

2. Collaborative Research: A projection method for constraint-free plasticity model integration. National Science Foundation, 2015-2018. *PI* Total Requested: $451,054, Foster Requesting: $190,519.

## Unfunded

1. Bridging the length scales through a unified nonlocal multiscale framework. National Science Foundation, 2014-2017. *PI* requested $234,407.

2. DOE Career: Nonlocal porous flow in evolving fractured media using peridynamic theory. Department of Energy, 2014-2017. *PI* Requested: $750,000.

3. BRIGE: A nonlocal mixture theory approach to fluid driven fracture with applications in energy production and environmental assessment. National Science Foundation, 2013-2015. Requested $174,702.

4. Investigating Cellular And Subcellular Behaviors and Metabolic Mechanisms Using Thermal and Raman Imaging Techniques, National Science Foundation, 2013-2016. Co-PI Requesting: $705,052

5. Dynamic Failure Mechanisms of Advanced Fiber Materials. Joint proposal with SwRI to the SwRI/UTSA CONNECT program, 2013. Requested $99,940.

6. Towards exascale computational mechanics: exploiting the newest generation of heterogenous HPC clusters. Oak Ridge Associated Universities Ralph E. Powe Junior Faculty Enhancement Award. Oak Ridge National Laboratories. Requesting: $10,000.

7. DOE Career: Nonlocal porous flow in evolving fractured media using peridynamic theory. Department of Energy, 2013-2016. Requesting: $749,875.

8. BRIGE: Identification and Simulation of Non-Local Effects to Improve Predictive Analysis of Heterogenous Materials. National Science Foundation, 2012-2014. Requested $174,805.

9. Discontinuous Flow and Angled Localization: Modern Challenges in Material Failure. Joint proposal with SwRI to the SwRI/UTSA CONNECT program, 2012. Requested $93,780.

10. A novel torsional Kolsky bar for testing materials at constant shear strain rates. Haythornthwaite Research Initiation Grant Program, 2011. Requested $13,388.

11. Joint proposal with SwRI in response to BAA AFOSR 2011-06 on University Center of Excellence: High-rate Deformation Physics of Heterogeneous Materials. AFOSR, 2011. Total Proposed: $5,000,000, Foster Requested: $377,518.

# Courses Taught

PGE 383 - Advanced Geomechanics (UT F2014)

ME 4953/5013 – Introduction to High-Performance Computing (UTSA F2012, F2013, S2014)

ME 6043 – Continuum Mechanics (UTSA F2012, F2014)

ME 4603 – Finite Element Analysis (UTSA F2011)

ME 400/500 – Numerical Methods (UNM F2010)

# Mentoring Activities

## *Postdoctoral Researcher's Supported*

1. Rezwanur Rahman, Ph.D.

2. Shamima Yasmin, Ph.D.

## *Graduate Students (Graduated)*

**MS**

1. Amanda Peterson, M.S.M.E 2014

2. Md. Imran Khan, M.S.M.E. 2014

3. Michael Brothers, M.S.M.E 2013

4. Jason York, M.S.M.E 2012

5. Arron Werthiem, M.S.M.E 2012 (KCI)

## *Graduate Students (In Progress)*

**PhD**

1. James O'Grady
   UTSA COE Valero Competitive Research Scholar

2. Jason York
   NSF Louis Stokes Allances for Minorty Participation (LSAMP) Fellow
   UTSA COE Valero Competitive Research Scholar

3. Michael Brothers

**MS**

1. Jake Montez

## Undergraduate Students (with financial support)

1. P. Eric Briseno, B.S.M.E. 2013

2. Robert Knobles, B.S.M.E. 2014 (Baker-Hughes)

3. Robert Brothers

4. Jason Crandall

## Graduate Commitee Member

Sarah Boukris, Ph.D. B.M.E, Daniel Sparkman, Ph.D. M.E., 2014
Khaled Mahmud, Saurav Kumar, M.S.M.E. 2013
Miguel Cortina, Carlos Acosta, David Wagner, M.S.M.E 2012

## External Commitee Member

Md. Essack, University of Cape Town, South Africa 2014

# Reviewer For

## Journals

Journal of Computational Particle Mechanics, Journal of Microelectromechanical Systems, Computational Mechanics, Int. Journal of Fracture, Applied Mathematics & Computation, Int. Journal of Impact Engineering, Engineering Fracture Mechanics, Experimental Mechanics, Review of Scientific Instruments, Int. Journal of Multiscale Computational Engineering, Int. Journal of Solids and Structures, CMC: Computers, Materials, & Continua, Journal of Mechanics of Materials and Structures.

## Books

*Split Hopkinson (Kolsky) Bar.* W. Chen and B. Song. Springer 2010.

## Book Proposals

CRC Press

## Organizations

Pi Tau Sigma - Mechanical Engineering Honor Fraternity, Tau Beta Pi - National Engineering Honor Society, American Society of Mechanical Engineers, American Institute of Aeronautics and Astronautics, Society for Experimental Mechanics – Dynamic Behavior of Materials Technical Division Committee Member, DYMAT, American Society for Engineering Education