Jorgen S. Bergstrom, Ph.D.

Dr. Jorgen Bergstrom is currently a Principal Engineer at Veryst Engineering LLC, an engineering consulting firm located in the Boston area. Veryst provides services in product design, manufacturing processes, and failure analysis. Dr. Bergstrom consults primarily in the modeling, testing, and failure analysis of mechanical behavior of materials, with emphasis on polymeric materials. His consulting work includes sensor design and analysis, polymer gaskets and hoses, injection molded components, and polymer films. He has worked with the National Institute of Health and the Department of Defense on the modeling and prediction of polymer behavior. He has developed world-recognized models for simulating the large deformation, rate-dependent, non-linear behavior of elastomers, thermoplastics, and thermosets. In addition to theoretical modeling, Dr. Bergstrom has significant experience with experimental material characterization, including mechanical testing, calorimetry, microscopy, chromatography, and spectroscopy. His consulting experience includes work within medical device, pharmaceutical, consumer product, energy, automotive, electrical component, semi-conductor, and transportation industries.

Dr. Bergstrom also works with particle and fiber-filled polymer composites. He has additional expertise in the behavior of brittle materials such as ceramics, ice, and rocks. This expertise includes research in fracture mechanics, crack nucleation, crack coalescence, and shear fault formation in brittle solids. Dr. Bergstrom also specializes in different computer simulation techniques, including finite element modeling, and advanced material model development. Dr. Bergstrom's expertise is applicable to problems in material processing, manufacturing simulation, product design, and failure analysis.

EDUCATION

Ph.D., Mechanical Engineering, Massachusetts Institute of Technology, 1999
M.S., Mechanical Engineering, Thayer School of Engineering, Dartmouth College, 1995
B.S., Mechanical Engineering, Thayer School of Engineering, Dartmouth College, 1993
B.S., Mechanical Engineering, Royal Institute of Technology, Stockholm, Sweden, 1992

SOCIETY MEMBERSHIPS

Sigma Xi, Scientific Research Honor Society; American Society of Mechanical Engineers; The Society of Plastics Engineers; Certified Composites Technician

BOOKS AND BOOK CHAPTERS

"Mechanics of Solid Polymers – Theory and Computational Modeling," William Andrew, 2015.

"Computer Modeling and Simulation of UHMWPE," In: Ultra-High Molecular Weight Polyethylene Handbook, Steven Kurtz (ed.), Elsevier, 2004.

"Modeling and Mechanical Analysis of Fluoropolymer Components," In: Fluoropolymers Applications in Chemical Processing Industries. Sina Ebnesajjad (ed.), Plastics Design Library, Williams Andrew Publishing, 2004.

PUBLICATIONS

"An Overview of Mechanical Properties and Material Modeling of Polylactide (PLA) for Medical Applications" Annals of Biomedical Engineering, DOI: 10.1007/s10439-015-1455-8, 2015 (with D. Hayman).

"Modellierung und konstruktion verstärker elastomerprodukte für öl- und gas-andwendungen," CAK Gummi Fasern Kunststoffe, Vol 68, March 2015 (with S. Brown and N. Elabbasi).

"Development and Experimental Validation of an Advanced Non-Linear, Rate-Dependent Constitutive Model for Polyether ether ketone (PEEK)," ASME Journal of Medical Devices, Vol. 7, 040908-1, 2013 (with D.J. Quinn and S. Chow).

"Modeling Inertial Focusing in Straight and Curved Microfluidic Channels," COMSOL News 2013, 42-43, 2013 (with J. Martel, M. Toner, N. Elabbasi, D. Quinn).

"An Advanced Thermomechanical Constitutive Model for UHMWPE," Int. J. Structural Changes in Solids, Vol 2, No 1, pp. 31-39, 2010 (with J.E. Bischoff).

"Computational modeling of dough sheeting and physical interpretation of the non-linear rheological behavior of wheat flour dough," J. Food Engineering, Vol 100, pp. 278-288, 2010 (with S. Chakrabarti-Bell, E. Lindskog, T. Sridhar).

"Evaluating pressure integrity of polymer ring seals for threaded connections in HP/HT wells and expandable casing," SPE Journal, Vol 13, No 1, pp. 123–132, 2008 (with LB Hilbert).

"Modeling of the Dynamic Thermomechanical Response of Elastomers," Tire Science and Technology, Vol. 33, No. 2, pp. 120-134, 2005.

"Failure Property Distributions for Conventional and Highly Crosslinked Ultra-High Molecular Weight Polyethylenes," Journal of Biomedical Materials Research: Part B - Applied Biomaterials, Vol. 73B, pp. 214–220, 2005 (with S.M. Kurtz and C.M. Rimnac).

"A Constitutive Model for Predicting the Large Deformation Thermomechanical Behavior of Fluoropolymers," Mechanics and Materials, Vol. 37, pp. 899–913, 2005 (with L.B. Hilbert).

"Molecular Chain Stretch is a Multiaxial Failure Criterion for Conventional and Highly Crosslinked UHMWPE," Journal of Orthopaedic Research, Vol. 23, pp. 367–375, 2005 (with C.M. Rimnac and S.M. Kurtz).

"An Augmented Hybrid Constitutive Model for Simulation of Unloading and Cyclic Loading Behavior of Conventional and Highly Crosslinked UHMWPE," Biomaterials, Vol. 25, pp. 2171–2178, 2004 (with C.M. Rimnac and S.M. Kurtz).

"FRP Flumes Real Impact—What Happens?" Composite Fabrication, pp. 32–34, April 2004 (with S. Brown).

"Prediction of Multiaxial Mechanical Behavior for Conventional and Highly Crosslinked UHMWPE Using a Hybrid Constitutive Model," Biomaterials, Vol. 24, pp. 1365–1380, 2003 (with S.M. Kurtz and C.M. Rimnac).

"Thermomechanical Behavior of Virgin and Highly Crosslinked Ultra-High Molecular Weight Polyethylene Used in Total Joint Replacements," Biomaterials, Vol. 23, pp. 3681–3697, 2002 (with S.M. Kurtz, M.L. Villarraga, M.P. Herr, C.M. Rimnac, and A.A. Edidin).

"Constitutive Modeling of Ultra-High Molecular Weight Polyethylene under Large-Deformation and Cyclic Loading Conditions," Biomaterials, Vol. 23, pp. 2329–2343, 2002 (with S.M. Kurtz, C.M. Rimnac, and A.A. Edidin).

"Miniature Specimen Shear Punch Test for UHMWPE used in Total Joint Replacements," Biomaterials, Vol. 23, pp. 1907–1919, 2002 (with S.M. Kurtz, C.W. Jewett, J.R. Foulds, and A.A. Edidin).

"A Progressive Damage Model for Failure by Shear Faulting in Polycrystalline Ice under Biaxial Compression," Int. J. Plasticity, Vol. 18, pp. 507–530, 2002 (with V. Gupta).

"Constitutive Modeling of the Time-dependent and Cyclic Loading of Elastomers and Application to Soft Biological Tissues," Mechanics of Materials, Vol. 33, pp. 523–530, 2001 (with M.C. Boyce).

"Deformation of Elastomeric Networks: Relation between Molecular Level Deformation and Classical Statistical Mechanics Models of Rubber Elasticity," Macromolecules, Vol. 34, No. 3, pp. 614–626, 2001 (with M.C. Boyce).

"Large Strain Time-Dependent Behavior of Filled Elastomers," Mechanics of Materials, Vol. 32, pp. 627–644, 2000 (with M.C. Boyce).

"Mechanical Behavior of Particle Filled Elastomers," Rubber Chem. Tech., Vol. 72, pp. 633-656, 1999 (with M.C. Boyce).

"Large Strain Time-Dependent Behavior of Elastomeric Materials," Ph.D. Thesis, MIT, 1999.

"Constitutive Modeling of the Large Strain Time-Dependent Behavior of Elastomers," J. Mech. Phys. Solids, Vol. 46, pp. 931–954, 1998 (with M.C. Boyce).

"Compressive Failure of Rocks by Shear Faulting," J. Geophys. Research-B: Solid Earth, Vol. 103, No. B10, pp. 23875–23895, 1998 (with V. Gupta).

"Effect of Step-Loading History and Related Grain-Boundary Fatigue in Freshwater Columnar Ice in the Brittle Deformation Regime," Phil. Mag. Letters, Vol. 77, No. 5, pp. 241–247, 1998, (with V. Gupta and C.R. Picu).

"Nucleation of Splitting Cracks in Columnar Freshwater Ice," Acta Mater, Vol. 45, No. 4, pp. 1411–1423, 1997 (with V. Gupta, and C.R. Picu).

"Brittle Failure of Columnar Freshwater Ice under Off-Axis Compression Loading," Scripta Materialia, Vol. 36, No. 1, pp. 63–67, 1997 (with C.R. Picu, and V. Gupta).

PRESENTATIONS AND PUBLISHED ABSTRACTS

"Constitutive Modeling of Polyethylene in COMSOL Multiphysics," paper presented at the 2015 COMSOL Conference in Boston, MA, October 7 (with N. Elabbasi).

"Impact Testing of Fiber-Reinforced Thermoplastics," paper presented at the 2015 Society of Plastics Engineers Automotive Composites Conference in Novi, MI, September 9, 2015 (with S. Brown, G. Freeburn, D. Hayman).

"Constitutive Modeling of Polyethylene," paper presented at the 2015 NAFEMS conference in San Diego, CA, June 24, 2015 (with N. Elabbasi).

"Material Modeling and Design Optimization Against Failure of PLA Under Cyclic and Monotonic Loading," paper presented at the Biomedical Engineering Society Frontiers in Medical Device Conference in Washington, DC, May 18, 2015 (with D. Hayman).

"Convergence Difficulties with Complex Polymer Material Models," paper presented at the 2015 ANSYS Convergence Conference in Chicago, IL, May 8, 2015 (with D. Hayman).

"Stent Modeling in the Absence of Accurate Tissue Models," paper presented at the 2015 ANSYS Convergence Conference in Chicago, IL, May 8, 2015 (with D. Hayman).

"Mechanical Testing and Characterization of a Thermoplastic Copolyester based Elastomer (DSM Engineering Plastics Arnitel® EM400)," paper presented at the 10th Annual Auto EPCON Conference in Troy, MI, May 5, 2015 (with J. Harding, S. Brown, G. Freeburn).

"Using Non-Linear Material Models in ANSYS Mechanical for Accurate Simulations," paper presented at the 2015 ANSYS Convergence Conference in Santa Clara, CA, April 21, 2015 (with D. Hayman).

"High Strain Rate Testing of Glass Fiber Reinforced PEEK," paper presented at the 2015 ANTEC meeting, Orlando, FL, March 23 (with S. Brown, G. Freeburn, D. Anderson, E. Ananny).

"Modeling of Reinforced Elastomeric Hoses," paper presented at the 2014 Simulia Community Conference, Providence, RI, May 19 (with S. Brown, N. Elabbasi).

"How to Select and Calibrate an Accurate Material Model for Polymers," paper presented at the 2014 Simulia Community Conference, Providence, RI, May 19 (with N. Elabbasi, F. Xu).

"Calibration and Experimental Validation of Advanced Constitutive Models for Polymeric Materials at High Strain Rates," paper presented at the ASME Verification and Validaton Symposium, May 7-9, 2014 (with E. Schmitt, D. Quinn, S. Chow, S. Brown, N. Elabassi).

"High Strain Rate Testing and Modeling of Polymers for Impact Simulations," paper presented at the 2014 ANTEC meeting, Las Vegas, NV, April 28 (with D. Quinn, E. Schmitt, S. Brown, S. Chow).

"Advanced Modeling of Bioresorbable PLA Medical Devices," paper presented at the 2013 ANTEC meeting, Cincinnati, OH, April 21-24.

"Development of a Non-Linear, Time and Rate-Dependent Constitutive Model for Polyether Ether Ketone (PEEK)," paper presented at the pre-ORS Meeting, Jan 13, 2013, San Antonio, TX (with D.J. Quinn, S. Show).

"Development and Experimental Validation of Advanced Non-Linear, Rate-Dependent Constitutive Models for Polymeric Materials," paper presented at the ASME Verification and Validation Symposium, Las Vegas, NV, May 2013 (with D.J. Quinn, N. Elabassi, S. Chow)

"Development and Experimental Validation of an Advanced Non-Linear, Rate-Dependent Constitutive Model for Polyether Ether Keytone (PEEK)," paper presented at the ASME/FDA Frontiers on Biomedical Devices, Washington, D.C., September 2013 (with D.J. Quinn, N. Elabassi, S. Chow).

"Non-Linear Viscoplastic Material Modeling of the Degradation Response of PLA," paper presented at the ASME/FDA Frontiers on Biomedical Devices, Washington, D.C., September 2013 (with D.J. Quinn, S. Chow).

"Modeling Inertial Focusing in Straight and Curved Microfluidic Channels," paper presented at the COMSOL, Boston, MA, October 2013 (with J. Martel, M. Toner, N. Elabbasi, D. Quinn).

"Micromechanical Analysis of Polymer-Nanofiber Composites," paper presented at Nanotech Conference and Expo 2012, June 18 (with C.R. Locker, X. Liu, A.H. Tsou, V.B. Buchholz, A.K. Mehta).

"Accurate Finite Element Simulations of PTFE Components," paper presented at the 2012 SIMULIA Community Conference, Providence, RI, May 17.

"Realistic Simulation of Golf Ball Impact," paper presented at the 2012 SIMULIA Community Conference, Providence, RI, May 17 (with X. Liu, D. Quinn).

"Advanced FE Modeling of Absorbable PLLA Screws," paper presented at the 2011 ANSYS Regional conference, Boston, September 14 (with D. Quinn, E. Schmitt).

"Bioresorbable Vascular Scaffold Material Model Development: From In Vitro to In Silico," paper presented at the 2011 FDA / NHLBI / NSF Workshop on Computer Methods for Medical Devices, Silver Spring, MD, September 9 (with S. Eswaran, V. Giddings).

"Advanced FE Modeling of Absorbable PLLA Screws," paper presented at the 2011 Abaqus Regional users meeting, Providence, RI, September 23 (with D. Quinn, E. Schmitt).

"Material Modeling of Polylactide," paper presented at the 2011 Simulia Customer Conference, Barcelona, Spain, May 17, 2011 (with S. Eswaran, A. Kelly, V. Giddings).

"Advanced User-Material Modeling of Catheter Kinking," paper presented at the 2010 ANSYS Regional Conferences in Boston on Oct 15.

"Computer Modeling of the Abbott Vascular Bioabsorbable Vascular Scaffold," paper presented at the FDA and NHLBI Third Annual Workshop of Cardiovascular Device Modeling, Rockville, MD, May 2010 (with V. Giddings, S. Eswaran, A. Kelly).

"Finite Element Modeling of Thermoplastics at Different Temperatures," paper presented at the 2010 Simulia Customer Conference, Providence, RI, May 2010.

"A Constitutive Model for Simple Wheat Flour Dough," paper presented at Dough Day at the University of Sydney, February 2010 (with S. Bell).

"A new material model framework for predicting the small-strain dynamic behavior of elastomers," paper presented at FEM-Materialmodelle mit Mullins- und Payne-Effekt Meeting at Deutsches Institut für Kautschuktechnologie, November 2009.

"Rheological model for wheat flour dough," paper presented at Xth International Gluten Workshop, Clermont Ferrand, FRANCE, September 2009 (with S. Bell).

"Deployment Mechanics of a Bioabsorbable Coronary Scaffold" paper presented at the FDA/NHLBI/NSF Cardiovascular Device Computational Modeling workshop, June 1-2, 2009 in Rockville, MD (with W. Falk and V. Giddings).

"Advanced Characterization of the Compression Behavior of Polyethylene", paper presented at the 55th Annual Meeting of the Orthopaedic Research Society, February 2009 in Las Vegas NV (with J. Bischoff, F. Wentoft).

"An Advanced Thermomechanical Constitutive Model for UHMWPE," paper presented at the 45th Annual Technical Meeting of the Society of Engineering Science, Urbana-Champaign, IL, October 2008.

"Dynamic Finite Element Modeling of Elastomers," paper presented at the 2008 Abaqus Users' Conference, Newport, RI, May 2008.

"Finite Element Modeling of Thermoplastics: How to Select an Accurate Material Model, " e-Presentation given for the Society of Plastics Engineers as part of Best of ANTEC 2006.

"A New Constitutive Model Framework for Polymer Foams," paper presented at the 43rd Annual Technical Meeting of the Society of Engineering Science, University Park, PA, August 2006.

"A Constitutive Model for Simple Wheat Flour Dough," paper presented at the 43rd Annual Technical Meeting of the Society of Engineering Science, University Park, PA, August 2006 (with S. Chakrabarti).

"Development and Implementation of an Advanced User Material Model for UHMWPE," paper presented at the 9th International LS-DYNA Users Conference, Dearborn, MI, June 2006 (with A. Bowden, S.M. Kurtz, C.M. Rimnac).

"Advanced Finite Element Modeling of Polymer Foam Components," paper presented at the 2006 ABAQUS Users' Conference, Boston, MA, May 2006.

"A Comparison of Different Material Models for Thermoplastics," paper presented at the Society of Plastics Engineers ANTEC, Charlotte, NC, May 2006.

"Rim Fracture Risk of Highly Crosslinked Polyethylene Total Disc Replacements," paper presented at the 6th annual Spine Arthroplasty Society Meeting, Montreal, Canada, 2006 (with A. Bowden, and S.M. Kurtz).

"Finite Element Modeling of a Thermoplastic Seal at High Temperature and Pressure," paper presented at ABAQUS East Regional Users' Meeting, Westborough, MA, November 2005 (with L.B. Hilbert).

"Dynamic Stress-Strain Behavior of Filled Natural Rubber under Combined Axial and Shear Straining," paper presented at European Conference on Constitutive Models for Rubber, KTH, Sweden, June 2005 (with W.V. Mars).

"Experimental Data and Constitutive Modeling of Elastomers," paper presented at the Society of Plastics Engineers ANTEC, Boston, MA, May 2005.

"Modeling of the Dynamic Thermomechanical Response of Elastomers," paper presented at the 23rd Annual Conference on Tire Science and Technology, Akron, OH, September 2004.

"Distributions of Ultimate Properties for Conventional and Highly Crosslinked UHMWPE," paper presented at the 7th World Biomaterials Congress, Sydney, Australia, May 2004 (with S.M. Kurtz and C.M. Rimnac).

"Failure Predictions of Highly Crosslinked UHMWPE," paper presented at the 7th World Biomaterials Congress, Sydney, Australia, May 2004 (with S.M. Kurtz and C.M. Rimnac).

"Predicting Failure Risk of TKA Designs Incorporating Highly Crosslinked UHMWPE," paper presented at the 7th World Biomaterials Congress, Sydney, Australia, May 2004 (with S.M. Kurtz, T. Harrigan, and C.M. Rimnac).

"Ultimate Property Distributions for Conventional and Highly Crosslinked UHMWPE," paper presented at the 50th Annual Meeting of the Orthopaedic Research Society, San Francisco, CA, March 2004 (with S.M. Kurtz, and C.M. Rimnac).

"Analysis of Stresses and Fracture Risk for Posterior-Stabilized TKA Designs Incorporating Highly Crosslinked UHMWPE," paper presented at the 50th Annual Meeting of the Orthopaedic Research Society, San Francisco, CA, March 2004 (with S.M. Kurtz, T. Harrigan, and C.M. Rimnac).

"Evaluating Pressure Integrity of Polymer Ring Seals for Threaded Connections in HP/HT Wells and Expandable Casing," paper presented at the IADC/SPE Drilling Conference, Dallas, TX, March 2004 (with L.B. Hilbert).

"Large Strain Time- and Temperature-Dependent Modeling of PTFE," Paper presented at 2nd MIT conference on Computational Fluid and Solid Mechanics, Cambridge, MA, June 2003 (with L.B. Hilbert, and S.B. Brown).

"Multiaxial Failure Modeling For Conventional and Highly Crosslinked UHMWPE," Paper presented at 29th Annual Meeting of the Society For Biomaterials, Reno, NV, May 2003 (with S.M. Kurtz, and C.M. Rimnac).

"Finite Element Modeling for Design and Failure Analysis of Polymer Materials," MTI Materials Technology Institute of the Chemicals Process Industries, Inc., TAC Meeting, Clearwater Beach, FL, Feb 2003 (with S. Brown).

"Constitutive Theories for UHMWPE for Monotonic and Cyclic Loading Conditions," Paper presented at 48th Annual Meeting of the Orthopaedic Research Society, Dallas, TX, February 2002.

"Constitutive Modeling of the Large Strain Time-Dependent Behavior of Particle Filled Elastomers," 159th Spring Technical Meeting of the Rubber Division of the American Chemical Society, Providence, RI, April 2001.

"Constitutive Theories for UHMWPE for Monotonic and Cyclic Loading Conditions," Paper presented at 27th Annual of the Society of Biomaterials, Saint Paul, MN, April 2001 (with S.M. Kurtz, C.M. Rimnac, and A.A. Edidin).

"Multiaxial Validation of Constitutive Theories for UHMWPE," Paper presented at 27th Annual of the Society of Biomaterials, Saint Paul, MN, April 2001 (with S.M. Kurtz, C.M. Rimnac, and A.A. Edidin).

"Time-Dependent Deformation in Elastomeric Materials," Paper presented at 35th Annual Technical Meeting of the Society of Engineering Science Inc., WA, September 1998 (with M.C. Boyce).

"Time-Dependence of Elastomeric Materials: Experiments and Modeling," Paper presented at 10th International Conference on Deformation, Yield and Fracture of Polymers, Cambridge, UK, April 1997 (with M.C. Boyce).

"Compressive Failure of Rocks," Paper presented at 36th U.S. Rock Mechanics Symposium, New York, June 1997 (with V. Gupta).

"Time and Strain Dependence of the Mechanical Behavior of Elastomers," Paper presented at Multiscale Materials Prediction Conference, MIT, September 1997 (with M.C. Boyce).