PETER SCHWARTZ

Professor
Department of Mechanical Engineering
Samuel Ginn College of Engineering
Auburn, AL 36849 USA
Phone: +1 334 844 4121
Fax: +1 334 844 3307
schwartz@auburn.edu

Research Interests

Mechanics of Fibrous Assemblies: stochastic modeling; braids & ropes.

Mechanics of Fiber-Reinforced Composite Materials: micromechanics of failure processes; creep-rupture of microcomposites; mechanics of hybrid composites; Monte Carlo simulations.

Fluid Flow Through Porous Media: forced flow percolation; Monte Carlo simulations.

Education

Ph.D. [Fiber & Polymer Science], 1981, North Carolina State University, Raleigh, NC.

M.A. [Mathematics], 1972, University of Pittsburgh, Pittsburgh, PA.

M.S. [Engineering Mechanics], 1970, Georgia Institute of Technology, Atlanta, GA.

B. Eng. [Textile Engineering], 1968, Georgia Institute of Technology, Atlanta, GA.

Professional Experience

Professor, Department of Mechanical Engineering, Auburn University, Auburn, AL, 2015-present.

Professor, Department of Polymer and Fiber Engineering, Auburn University, Auburn, AL, 2013-2015.

Professor & Head, Department of Polymer and Fiber Engineering, Auburn University, Auburn, AL, 2006-2013.

Editorial Board, Indian Journal of Fibre & Textile Research: 2015-present.

Editorial Board, *Textile Research Journal*: 2006-present.

Professor & Head, Department of Textile Engineering, Auburn University, Auburn, AL, 2001-2006.

Professor Emeritus, Department of Fiber Science and Apparel Design, Cornell University, Ithaca, NY, 2002-present.

Professor, Department of Textiles and Apparel, Cornell University, Ithaca, NY, 1994-2002.

Gastprofessor: Ab. Kunststoffe und Verbundwerkstoffe, Technische Universität Hamburg-Harburg, Harburg, DE, October 1997-February 1998.

Faculty, Bioengineering Program, Cornell University, Ithaca, NY, 1996-2001.

Editorial Board, *Advanced Composites Letters*, 1993-2010.

Director of Undergraduate Studies, Department of Textiles and Apparel, Cornell University, Ithaca, NY, 1992-1999.

Faculty, Program in Biology and Society, Cornell University, Ithaca, NY, 1990-2001.

Visiting Associate Professor, Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, MA, January 1989-July 1989.

Associate Professor (with indefinite tenure), Department of Textiles and Apparel, Cornell University, Ithaca, NY, 1987-1994.

Assistant Professor, Department of Textiles and Apparel, Cornell University, Ithaca, NY, 1982-1987.

Instructor, Department of Textile Materials and Management, North Carolina State University, Raleigh, NC, 1976-1982.

Part-Time Instructor, Crawford County Vocational-Technical School, Meadville, PA, 1974-1975.

Senior Engineer, Product Design and Manufacturing Engineering, Talon/TEXTRON, Meadville, PA, 1972-1976.

Teaching Fellow, Department of Mathematics, University of Pittsburgh, Pittsburgh, PA, 1971-1972.

Teaching Assistant, Departments of Mechanical Engineering and Industrial Engineering, University of Pittsburgh, Pittsburgh, PA, 1970-1971.

Teaching Assistant, Department of Mathematics, Georgia Institute of Technology, Atlanta, GA, 1969-1970.

Textile Engineer, Fiber Glass Research, PPG Industries, Harmar Twp., PA, June 1968-December 1968.

Honors, Prizes, and Awards

Outstanding Faculty Member in Polymer and Fiber Engineering, 2013
Gamma Sigma Delta Distinguished Research Award, 1995
ASTM Committee D-13 Harold DeWitt Smith Memorial Award, 1994
Kappa Omicron Nu/Human Ecology Alumni Distinguished Teaching Award, 1993
Andrew D. White Outstanding Faculty Award, 1992
Honor Society of Gamma Sigma Delta, 1991
Fiber Society Distinguished Lecturer, 1990-1991
N. C. State Academy of Outstanding Teachers, 1982
Honor Society of Phi Kappa Phi, 1981
Society of Sigma Xi, 1981
Harry Reimer Honor Award, 1968

Refereed Publications

Ünsal, E., Dane, J. H., Schwartz, P., and Dozier, G. V., "Modeling Displacement Properties of Immiscible Fluids in Porous Media." *Simulation*, **82**, 499-510 (2006).

Ünsal, E., Dane, J. H., and Schwartz, P., "Effect of Liquid Characteristics on Wetting, Capillary Migration and Retention Properties of Fibrous Polymer Networks." *J. Appl. Polym. Sci.*, **97**, 282-292 (2005).

Ünsal, E., Schwartz, P., and Dane J. H., "Role of Capillarity on Penetration into and Flow Through Fibrous Barrier Materials." *J. Appl. Polym. Sci.*, **95**, 841-846 (2005).

Miller, A and Schwartz, P., "Forced Flow Percolation for Modeling of Liquid Penetration of Barrier Materials." *J. Text. Inst., Part 1*, **92**, 53-62 (2002).

Hoffmann, M. P., Kuhar, T. P., Baird, J. M., Gardner, J., Schwartz, P., and Shelton, A. M., "Nonwoven Fiber Barriers for Control of Cabbage Maggot and Onion Maggot (*Diptera: Anthomyiidae*)." *J. Econ. Entomol.*, **94**, 1485-1491 (2001).

Kazanci, M., Schwartz, P., and Phoenix, S. L., "The Effect of Matrix Stiffness on the Creep-Rupture Lifetime of Carbon Fiber/Epoxy Composites. *Compos. Struct.* **54**, 221-223 (2001).

Weber, I. and Schwartz, P., "Monitoring Bending Fatigue in Carbon Fiber/Epoxy Composite Strands: A Comparison between Mechanical and Resistance Techniques." *Compos. Sci. Technol.*, **61**, 849-853 (2001).

Köster, K. and Schwartz, P., "Influence of Acetylene Plasma Treatment on the Torsional Fatigue of Carbon Fiber Reinforced Composite Strands." *Compos. Sci. Technol.*, **60**, 2005-2010 (2000).

Miller, A. and Schwartz, P., "A Test Methodology for the Study of Liquid Penetration of Barrier Materials." *Text. Res. J.*, **70**, 77-83 (2000).

Feih, S. and Schwartz, P., "Modification of the Carbon Fiber/Matrix Interface using Gas Plasma Treatment with Acetylene and Oxygen." *J. Adhesion Sci. Technol.*, **12**, 523-529 (1998).

Lee, P.-T. and Schwartz, P., "Torsional Fatigue in Carbon Fiber/Epoxy Strands." *Adv. Compos. Lett.*, **6**, 127-130 (1997).

Miller, A. and Schwartz, P., "Effects of Aging on Plasma Treated Ultra High Strength Polyethylene and the Plasma Treated Ultra High Strength Polyethylene/Epoxy Interface." *Plasma and Polymers*, **2**, 115-132 (1997).

Feih, S. and Schwartz, P., "FEM Analysis and Comparison of Single Fiber Pull-Out Tests." *Adv. Compos. Lett.*, **6**, 99-102 (1997).

Straub, A., Slivka, M., and Schwartz, P., "Time and Temperature Effects on the Fiber/Matrix Interface Strength using the Microbond Technique." *Compos. Sci. Technol.*, **57**, 991-994 (1997).

Couillard, R. A. A. and Schwartz, P., "Bending Fatigue of Carbon-Fiber-Reinforced Epoxy Composite Strands." *Compos. Sci. Technol.*, **57**, 229-235 (1997).

Stumpf, H., Schwartz, P., Lienkamp, M., and Schulte, K, "S-Glass/Kevlar-149 Hybrid Microcomposites in Stress Rupture: A Monte Carlo Simulation." *Compos. Sci. Technol.*, **54**, 211-221 (1995).

Ahn, H. S. and Schwartz, P., "Measurement of Interfacial Adhesion in Composite/Epoxy Composites after Plasma Surface Treatment on Carbon Fibers." *Adv. Compos. Lett.*, **3**, 27-29 (1994).

Knickrehm, A., Rehm, W, and Schwartz, P., "Effect of Argon Plasma re-treatment on Adhesion of Epoxyto Aramid Fibers Treated with Oxygen Plasmas." *Adv. Compos. Lett.*, **2**, 211-213 (1993).

Hild, D. N. and Schwartz, P., "Plasma Treated Ultra High Strength Polyethylene Fibers for Improved Fracture Toughness of Poly(methyl Methacrylate)." *J. Mater Sci.: Materials in Medicine*, **4**, 481-493 (1993).

Stumpf, H. and Schwartz, P., "A Monte Carlo Simulation of Seven-Fiber Microcomposites in Stress-Rupture." *Compos. Sci. Technol.*, **49**, 251-263 (1993).

Qiu, Y., DeFlon, S., and Schwartz, P., "Treatment of Poly(*p*-phenylene benzobisthiozol) Fibers for Improved Adhesion with Epoxy." *J. Adhesion Sci. Technol.*, **7**, 1041-1049 (1993).

Sastry, A. M., Phoenix, S. L., and Schwartz, P., "Analysis of Interfacial Failure in a Composite Microbundle Pull-Out Experiment." *Compos. Sci. Technol.*, **48**, 237-251 (1993).

Qiu, Y. and Schwartz, P., "Single Fiber Pullout from a Microcomposite Test." *Compos. Sci. Technol.*, 48, 5-10 (1993).

Qiu, Y. and Schwartz, P., "Micromechanical Behaviour of Kevlar 149/S-Glass Hybrid Seven Fiber Microcomposite: II. Stochastic Modeling of Stress Rupture of Hybrid Composite." *Compos. Sci. Technol.,* **47**, 303-316 (1993).

Qiu, Y. and Schwartz, P., "Micromechanical Behaviour of Kevlar 149/S-Glass Hybrid Seven Fiber Microcomposite: I. Tensile Strength of the Hybrid Composite." *Compos. Sci. Technol.*, **47**, 289-302 1993).

Seo, M. H., Realff, M. L., Pan, N., Boyce, M. C., Schwartz, P., and Backer, S., "Mechanical Properties of Fabrics Woven from Yarns Produced by Different Spinning Technologies: Yarn Failure in a Woven Fabric." *Text. Res. J.*, **63**, 123-164 (1993).

Lienkamp, M. and Schwartz, P., "A Monte Carlo Simulation of the failure of a 7-Fiber Microcomposite." *Compos. Sci. Technol.*, **46**, 139-146 (1993).

Hild, D. N. and Schwartz, P., "Plasma Treated Ultra-High Strength Polyethylene Fibers. Part II: Mechanical Properties of PMMA Composites." *J. Adhesion Sci. Technol.*, **6**, 897-921 (1992).

Hild, D. N. and Schwartz, P., "Plasma Treated Ultra-High Strength Polyethylene Fibers. Part I: Characterization by Electron Spectroscopy for Chemical Analysis ." *J. Adhesion Sci. Technol.*, **6**, 879-896 (1992).

Toney, M. and Schwartz, P., "Bending and Torsional Fatigue of Nylon 66 Monofilaments." *J. Appl. Polym. Sci.,* **46**, 2023-2032 (1992).

Heirigs, L. T. and Schwartz, P., "The Properties of Small Diameter Aramid Double Braids: Fatigue lifetime, Strength Retention after Abrasion, and Strength Modeling." *Text. Res. J.*, **62**, 397-402 (1992).

Qiu, Y. and Schwartz, P., "Studies of the Fiber Matrix Interface in Composites Using a New Method: Single Fiber Pull-Out from a Microcomposite." *J. Adhesion Sci. Technol.*, **5**, 741-756 (1991).

Gulino, R., Schwartz, P., and Phoenix, S. L., "Experiments on the Shear Deformation, Debonding and Local Load Transfer in a Model Graphite/Glass/Epoxy Microcomposite." *J. Mater. Sci.*, **26**, 6655-6672 (1991).

Küpper, K. and Schwartz, P., "Modification of Fiber/Matrix Interface of *p*-Aramid Fibers Using Gas Plasmas." *J. Adhesion Sci. Technol.*, **5**, 165-176 (1991).

Realff, M. L., Seo, M., Boyce, M. C., Schwartz, P., and Backer, S., "On the Mechanical Properties of Fabrics Woven from Yarns Produced by Different Spinning Technologies: Yarn Failure as a Function of Gauge Length." *Text. Res. J.*, **61**, 517-530 (1991).

Boyce, M. C., Palmer, M. L., Seo, M. H., Schwartz, P., and Backer, S., "A Model of the Tensile Failure Process in Woven Fabrics." *J. Appl. Polym. Sci. : Appl. Polym. Symp.*, **47**, 383-402 (1991).

Holmes, S. and Schwartz, P., "Amination of Ultra-High Strength Polyethylene using Ammonia Plasma." *Compos. Sci. Technol.*, **38**, 1-21 (1990).

Netravali, A. N., Phoenix, S. L., and Schwartz, P., "Study of Interfaces of High Performance Glass Fibers and DGEBA Based Epoxy Resins using Single-Fiber-Composite Test." *Polym. Compos.*, **10**, 385-388 (1989).

Sampathkumar, V. and Schwartz, P., "The Effect of Salt Water Immersion on the Ultimate Tensile Strength of Small Diameter Aramid Braids." *Text. Res. J.*, **59**, 94-97 (1989).

Netravali, A. N., Henstenburg, R. B., Phoenix, S. L., and Schwartz, P., "Interfacial Shear Strength Studies using the Single-Filament Composite Test I: Experiments on Graphite Fibers in Epoxy." *Polym. Compos.*, **10**, 226-241 (1989).

Shahpurwala, A. A. and Schwartz, P., "Modeling Woven Fabric Tensile Strength using Statistical Bundle Theory." *Text. Res. J.*, **59**, 26-32 (1989).

Phoenix, S. L., Schwartz, and Robinson, H. H., IV, "Statistics for the Strength and Lifetime in Creep-Rupture of Model Carbon/Epoxy Composites." *Compos. Sci. Technol.*, **32**, 81-120 (1988).

Wu, H. F., Phoenix, S. L., and Schwartz, P., " Temperature Dependence of Lifetime Statistics for Single Kevlar 49 Filaments in Creep-Rupture." *J. Mater. Sci.*, **23** 1851-1860 (1988).

Weinberg, A. and Schwartz, P., "Twist Effects on the Mechanical Behavior of Kevlar 29/Epoxy Strands." *J. Mater. Sci. Lett.*, **6**(7), 832-834 (1987).

Weinberg, A. and Schwartz, P., "Effect of Fibre Volume Fraction on the Strength of Kevlar-29/Epoxy Strands." *J. Mater Sci. Lett.*, **6**, 183-184 (1987).

Pourdeyhimi, B., Wagner, H. D., and Schwartz, P., "A Comparison of Mechanical Properties of Discontinuous Kevlar 29 Fibre Reinforced Bone and Dental Cements." *J. Mater. Sci.*, **21**, 4468-4474 (1986).

Schwartz, P., Netravali, A., and Sembach, S., "The Effects of Strain Rate and Gauge Length on the Failure of Ultra-High Strength Polyethylene Fibers." *Text. Res. J.*, **56**, 502-508 (1986).

Pourdeyhimi, B., Robinson, H. H., IV, Schwartz, P., and Wagner, H. D., "Fracture Toughness of Kevlar 29/Poly(methyl methacrylate) Composite Materials for Surgical Implants." *Ann. Biomed. Engr.*, **14**, 27-294 (1986).

Wagner, H. D., Schwartz, P., and Phoenix, S. L., "Lifetime Statistics for Single Kevlar 49 Filaments in Creep-Rupture." *J. Mater. Sci.*, **21**, 1868-1878 (1986).

Schwartz, P., Rosensaft, M., and Wagner, H. D., "The Effects of Filament Diameter Variability on the Failure of Kevlar 49/Epoxy Strands." *J. Mater. Sci. Lett.*, **4**, 1409-1412 (1985).

Mooney, C. L. and Schwartz, P., "The Effect of Salt Spray on the Rate of Water VaporTransmision in Microporous Fabrics." *Text. Res. J.*, **55**, 449-452 (1985).

Wagner, H. D., Phoenix, S. L., and Schwartz, P., "A Study of Statistical Variability in the Strength of Single Aramid Filaments." *J. Compos.Mater.*, **18**, 312-338 (1984).

Schwartz, P., "Complex Triaxial Fabrics: Cover, Flexural Rigidity, and Tear Strength. *Text. Res. J.*, **54**, 581-584 (1984).

Schwartz, P., A Mathematical Analysis of a Fabric Having Nonorthogonal Interlacings Using Strain Energy Methods." *Fibre Sci. Technol.*, **20**, 273-282 (1984).

Schwartz, P., "The Effect of Jamming on Seam Pucker in Plain Woven Fabrics." *Text. Res. J.*, **54**, 32-34 (1984).

Schwarz, P., "Bending Properties of Triaxially Woven Fabrics." *Text. Res. J.*, **52**, 604-606 (1982).

Schwartz, P., Fornes, R. E., and Mohamed, M., "An Analysis of the Mechanical Behavior of Triaxial Fabrics and the Equivalency of Conventional Fabrics." *Text. Res. J.*, **52**, 388-394 (1982).

Schwartz, P., Fornes, R. E., and Mohamed, M. H., "Tensile Properties of Triaxial Fabrics Under Biaxial Loading." *Trans. Of ASME, J. Engr. Industry*, **102**, 327-332 (1980).

Patent

Hoffmann, M., Baird, J., and Schwartz, P., "Non-woven Fiber Barriers for Control of Agricultural Pests," United States Patent 6054923, 25 April 2000.

Books

Schwartz, P., ed., *Structure and mechanics of textile fibre assemblies*. Cambridge, UK: Woodhead Publishing Limited, 2008.

Schwartz, P., Rhodes, T., and Mohamed, M., *Fabric Forming Systems*. Park Ridge, NJ: Noyes Publications, 1982.

Book Chapters, Encyclopedia Entries

Schwartz, P., "Measuring Interface Strength in Composite Materials." *Surface Characteristics of Fibers and Textiles: Part III*, C. Pastore, ed. New York: Marcel Dekker, 219-233, 2001.

Bunsell, A. R. and Schwartz, P., "Fibre Test Methods." *Comprehensive Composite Materials, v. 5*, L. Carlsson, R. L. Crane, and K. Unchio, v. eds, A Kelley and C. Zweben, eds. Oxford, UK: Elsevier, 49-70, 2000.

Schwartz, P., "Textile Product Flammability." *Encyclopedia of the Consumer Movement,* S. Brobeck, ed. Santa Barbara: ABC-CLIO, 562-563, 1997.

Schwartz, P., Rhodes, T, and Mohamed, M. H., "Textiles,Woven." *Encyclopedia of Chemical Processing and Design, v.57*, J. J. McKetta and G. E. Weismantel, eds. New York: Marcel Dekker, 186-214, 1996.

Schwartz, P., Stumpf, H., and Lienkamp, M., "Monte Carlo Simulations of the Strength and Stress-Rupture of Seven-Fiber Graphite/Epoxy Composites." *Computational Stochastic Mechanics: Theory, Computational Methodology, and Application*. A. H.-D. Chung and C. Y. Yang, eds. London: Computational Mechanics Publications: Southhampton/Elsevier Applied Science, 395-424 (1993).

Schwartz, P., "Statistics for the Short Term Strength and Creep Rupture of Para-Aramid Fibers." *Polymer and Fiber Science: Recent Advances*. R.E. Fornes and R. D. Gilbert, eds., H. Mark, hon. ed. New York: VCH Publishers, 521-531, 1989.

Schwartz, P., "Creep Rupture." *Encyclopedia of Composites, v. 1*, S. M. Lee, ed. New York: VCH Publishers, 521-531, 1989.

Graduate Theses/Projects (M.Eng.) Supervised

Ünsal, E., 2003, *Numerical Modeling of Flow Through Porous Media.* Ph.D. [Integrated Textile and Apparel Science].

Mittal, J., 2000, *Using Renormalization to Model the Strength of Carbon Fiber Epoxy Strands*. M.S. [Fiber Science].

Lin, C.-y., 2000, *Design and Construction of a Device for Electro-spinning Polymer Fibers*. M.Eng. [Mechanical Engineering].

Luellen, J., 2000, *Materials Handling.* M.Eng. [Mechanical Engineering].

Chen, Z., 2000, *Electrostatic Spinning of Fibers from the Melt*. M.S. [Fiber Science].

Weber, I., 1999, *Monitoring the Bending Fatigue of Carbon Fiber Reinforced Epoxy Composite Strands using Resistance Techniques*. M.Eng. [Mechanical Engineering].

Couillard, R. A. A., 1998, *Production and Analysis of Extremely Fine Polymeric Fibers Created by the Application of an Electrostatic Field*. Ph.d. [Fiber Science].

Miller, A. M., 1998, *Liquid Penetration of Barrier Materials*. Ph.D. [Fiber Science].

Köster, K. F., 1998, *Torsional Fatigue of Carbon Fiber Reinforced Epoxy Composite Strands and the Influence of Plasma Treatment on the Fatigue Behavior*. M.Eng. [Mechanical Engineering].

Feih, S., 1995. *Influence of Plasma Treatment with Acetylene and Oxygen at Different Ratios and Treatment Times on the Chemical Properties of the Carbon Fiber Surface and the Shear Strength of a Carbon Fiber/Epoxy Interface.* M.Eng. [Mechanical Engineering].

Miller, A. M., 1996, *Effect of Aging on Interface Strength in Plasma treated Polyethylene Fiber Reinforced Composites*. M.S. [Fiber Science].

Kazanci, M., 1995, *Creep-Rupture Lifetime as a Function of Matrix Stiffness*. M.S. [Fiber Science].

Couillard, R. A. A., 1995, *Bending Fatigue of Carbon Fiber Reinforced Epoxy Composite Strands*. M.S. [Fiber Science].

Straub, A., 1995, *Prediction of the Thermo-Viscoelastic Behavior in a Kevlar/Epoxy Composite using the Microbond Test under Different Temperatures and Strain Rates*. M.Eng. [Mechanical Engineering].

Bentley, M. A., 1994, *Quality Function Deployment: A Computer Program to Develop a Quality Function Development Chart for Engineering Projects*. M. Eng. [Mechanical Engineering].

Rehm, W., 1993, *Analysis of the Surface of Aramid Fibers after Gas Plasma Treatment and Plasma Polymerization using Environmental Scanning Electron Microscopy and Fourier Transform Infrared Spectroscopy*. M. Eng. [Mechanical Engineering].

Knickrehm, A., 1993, *Measurement of Bonding Properties in a Kevlar/Epoxy Composite after Fiber Surface Modification with Plasma Treatment*. M. Eng. [Mechanical Engineering].

Stumpf, H., 1992, *Stochastic Modeling of the Creep-Rupture of a 7-Fiber Hybrid Composite*. M. Eng. [Mechanical Engineering].

Qiu, Y., 1992, *A Stochastic Model for the Strength and Creep Lifetime of Hybrid Composites*. Ph.D. [Fiber Science].

Lienkamp, M., 1991, *Stochastic Modeling of the Strength of a 7-Fiber Hybrid Composite*. M. Eng. [Mechanical Engineering].

Heirigs, L. M., 1991, *Fatigue of Nylon and Polyester Sheathed Aramid Double Braids*. M.S. [Fiber Science].

Hild, D. N., 1991, *Toughening of Acrylic Bone Cements using Gas Plasma Treated Polyethylene Fibers*. Ph.D. [Fiber Science].

Toney, M. M., 1991, *Bending and Torsional Fatigue of Nylon 66 Monofilaments*. Ph.D. [Fiber Science].

Küpper, K., 1990, *Modification of Fiber/Matrix Interface of* p*-Aramid Fibers using Gas Plasma*. M. Eng. [Mechanical Engineering].

Sembach, S. A., 1988, *Ammonia Plasma Treatment of Ultra High Strength Polyethylene Fabric*. M.S. [Fiber Science].

Shahpurwala, A. A., 1987, *The Use of Statistical Methods to Understand and Predict the Tensile Failure of Woven Fabrics*. M.S. [Fiber Science].

Sampathkumar, V., 1987, *Effect of Sea Water Immersion on the Tensile Strength of Aramid Braids*. M.S. [Fiber Science].

Robinson, H. H., IV, 1987, *Elements on the Strength and Creep Rupture of Carbon/Epoxy Microcomposites*. M.S. [Mechanical Engineering].

Mandaiker, S. V., 1985, *Mechanical Behaviour of Small Diameter Aramid Braids*. M.S. [Fiber Science].

Mooney, C. L., 1984, *An Analysis of the Physical Properties of Two Microporous Fabrics in Relation to Current and Future End Use*. M.S. [Fiber Science].

Professional Affiliations

American Chemical Society (ACS)
American Society for Engineering Education (ASEE)
American Society of Mechanical Engineers (ASME)

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