

Curriculum Vitae

Russell G. Keanini

Professor

Department of Mechanical Engineering and Engineering Science

The University of North Carolina at Charlotte

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Education:

Colorado School of Mines	Chemical and Petroleum Refining Engineering	B.Sc. 1983
University of Colorado, Denver	Mechanical Engineering	M.S. 1987
University of California, Berkeley	Mechanical Engineering	Ph.D. 1992

Professional Experience:

Professor (2007-present); Associate Professor (1998-2007); Assistant Professor (1992-98), Department of Mechanical Engineering and Engineering Science, University of North Carolina at Charlotte

NASA Graduate Student Researcher, Photophysics Group (1988-89), NASA Ames Research Center

Graduate Research Assistant, Department of Mechanical Engineering, University of California at Berkeley (1987-1992)

Graduate Research Assistant, Department of Mechanical Engineering, University of Colorado at Denver (1986-1987)

Member U.S. Naval Inactive Ready Reserve (1984-1990)

Research Interests:

Statistical mechanics, fluid mechanics, molecular hydrodynamics, applied math

Journal Publications:

- Keanini, R. G., Tkacik, P. T., Fleischhauer, E., Shahinian, H., Sholar, J., Azimi, F. and Mullany, B. (2017) "Macroscopic liquid-state molecular hydrodynamics," *Scientific Reports*, **7**, 41658.
- Eppes, M. and Keanini, R.G. (2017) "Mechanical weathering and rock erosion by climate-dependent subcritical cracking," in press, *Reviews of Geophysics*.
- Mullany, B., Shahinian, H., Navare, J., Azimi, F., Fleischhauer, E., Tkacik, P. and Keanini, R. G. (2017) "The application of computational fluid dynamics to vibratory finishing processes," in press, *CIRP Annals - Manufacturing Technology*.
- Dahlberg, J., Tkacik, P. T., Mullany, B., Fleischhauer, E., Shahinian, H., Azimi, F., Navare, J., Owen, S., Bisel, T., Martin, T. and Keanini, R.G. (2017) "An analog macroscopic technique for studying molecular hydrodynamic processes in dense gasses and liquids," submitted *J. of Visualized Experiments*.
- Fleischhauer, E., Azimi, F., Tkacik, P., Keanini, R. and Mullany, B. (2016). "Application of particle image velocimetry (PIV) to vibrational finishing," *Journal of Materials Processing Technology*, **229**, pp. 322-328.
- Keanini, R. G., Tkacik, P., Srivastava, N., Thorsett-Hill, K., and Tomsyck, J. (2014) "Millisecond-scale shock-train evolution in high pressure ratio rocket nozzles: schlieren imaging and qualitative analysis of shock-boundary layer interaction," *Proc. Inst. Mech. Engrs. G, J. Aerospace Engrg.*, **228**, pp. 1076-1082.
- Mullany, B., Mainuddin, M., Williams, W., and Keanini, R. G. (2013) "Experimental and analytical investigation into the effects of process vibrations on material removal rates during polishing," *J. Applied Phys.*, **113**, 224902.
- Kennedy, B., Weggel, D. C., and Keanini, R.G. (2013) "Experimental program and simplified nonlinear design expression for glass curtain walls with low-level blast resistance," *Int. J. Computational Meths. and Experimental Measurements*, **1**, pp. 1-23.
- Srivastava, N., Tkacik, P., and Keanini, R. G. (2012) "Ascending rockets as self-propelled Brownian oscillators," *Proc. Royal Society A*, **468**, pp. 3965-3994.
- Keanini, R. G. (2011) "Green's function-stochastic methods framework for probing nonlinear problems: Burgers' equation, nonlinear Shrodinger's equation, and hydrodynamic organization of near-molecular-scale vorticity," *Annals of Physics*, **326**, pp. 1002-1031.(Also, arXiv:1007.2125.)
- Keanini, R. G., Srivastava, N. Tkacik, P., Weggel, D. C., and Knight P. D. (2011) "Stochastic rocket dynamics under random nozzle side loads: Ornstein-Uhlenbeck boundary layer separation and its course grained connection to side loading and rocket response," *Annalen der Physik*, **523**, pp. 459-487.
- Srivastava, N., Tkacik, P. and Keanini, R. G. (2010) "On the influence of nozzle random side loads on launch vehicle dynamics," *J. Applied Physics*, **108**, pp. 044911-044919.
- Tkacik, P. , Keanini, R. G., Srivastava, N. and Tkacik, M. P. (2011) "Color Schlieren imaging of high pressure rocket nozzle flow using a simple, low cost test apparatus," *J. of Visualization*, **14**, pp. 11-14.
- Keanini, R.G. (2007) "Random Walk Methods for Scalar Transport Problems Subject to Dirichlet, Neumann, and Mixed Boundary Conditions," *Proc. Royal Soc. A: Math., Phys., and Engrg.*, **453**, pp. 435-460.
- Keanini, R. G. and Brown, A. (2007) "Scale Analysis and Experimental Investigation of Compressible Turbulent Boundary Layer Separation in Nozzles," *Euro. J. Mech. B - Fluids*, **26**, pp. 494-510.

- Keanini, R.G., Thompson, J., and Gona, K. (2007) "Linear and Nonlinear Waves on Fiber Coating Entrance Menisci," *Far East J. Appl. Math*, **28**, pp.173-182.
- Keanini, R.G., Watkins, G., Koike, M., and Okabe, T. (2007) "Theoretical study of alpha case formation during titanium casting," *Metallurgical and Materials Transactions B*, **38**, pp. 729-732.
- Keanini, R.G., Watanabe, K. and Okabe, T. (2005) "Theoretical Model of the Two-Chamber Pressure Casting Process," *Metallurgical and Materials Transactions B*, **36**, pp. 283-292.
- Ling, X., Keanini, R.G. and Cherukuri, H.P. (2005) "An Implicitly Regularized Noniterative Finite Element Method for Parabolic Inverse Heat Conduction Problems," *Computational Mechanics*, **36**, pp. 117-128.
- Ling, X., Keanini, R.G., Cherukuri, H.P. and Smelser, R. (2004) "An Inverse Method for Estimating Surface heat Fluxes with Application to a Quenching Problem," *AIP Conference Proceedings*, **712**, pp. 1191-1196.
- Lawton, K.M., Patterson, S. and Keanini, R.G. (2003) "Direct Contact Packed Bed Thermal Gradient Attenuators: Theoretical Analysis and Experimental Observations," *Rev. Scientific Instruments*, **74**, pp. 2886-2893.
- Ling, X., Keanini, R.G. and Cherukuri, H.P. (2003) "A Noniterative Finite Element Method for Inverse Heat Conduction Problems," *Int. J. Numerical Methods in Engrg.*, **56**, pp. 1315-1334.
- Okabe, T., Elvebak, B., Carrasco, L., Ferracane, J.L., Keanini, R.G. and Nakajima, H. (2003) "Mercury Release from Dental Amalgams into Continuously Replenished Liquids," *Dental Materials*, **19**, pp. 38-45.
- Phan, S., Hocken, R.J., Smith, S.T., and Keanini, R.G. (2002) "Simultaneous Measurement of Spatially Separated Forces Using a Dual-Cantilever Resonance-Based Touch Sensor," *Rev. Sci. Instrum.*, **73**, 318-322.
- Lawton, K.M., Patterson, S., and Keanini, R.G. (2001) "Precision Temperature Control of High-Throughput Fluid Flows: Experimental and Theoretical Analysis," *J. of Heat Transfer*, **123**, 796-802.
- Keanini, R.G., Ferracane, J., and Okabe, T. (2001) "Theoretical Models of Mercury Dissolution from Dental Amalgams in Neutral and Acidic Flows," *Metallurgical and Materials Transactions B*, **32B**, 409-416.
- Keanini, R. G. (2000) "Structure and Particle Transport in Second-Order Stokes Flow," *Phys Rev. E*, **61**, 6606-6620.
- Keanini, R.G., Phan, S., Smith, S.T., and Hocken, R.J. (2000) "Resonance-based Pressure Measurement and Anemometry for High Temperature Flows: Design Principles and Preliminary Results," *Int. Comms. Heat Mass Transfer*, **27**, 273-284.
- Schweikert, R.J. and Keanini, R.G. (1999) "Finite Element and Order of Magnitude Analysis of Cryosurgery in the Lung," *Int. Comms. Heat and Mass Transfer*, **26**, 1-12.
- Keanini, R.G. (1999) "An Implicit Method for Reconstructing Dynamic Three-dimensional Phase Boundaries Under Low Peclet Number Conditions," *Int. J. Heat and Mass Transfer*, **42**, 1863-1884.
- Keanini, R.G. (1998) "Inverse Estimation of Surface Heat Flux Distributions During High Speed Rolling Using Remote Thermal Measurements," *Int. J. Heat and Mass Transfer*, **41**, pp. 275-285.
- Johnson, R.E. and Keanini, R.G. (1998) "An Asymptotic Model of Work Roll Heat Transfer in Strip Rolling," *Int. J. Heat and Mass Transfer*, **41**, pp. 871-879.
- Keanini, R.G. (1997) "Review: Reconstruction and Control of Phase Boundaries during Fusion Welding," *Trends in Heat, Mass & Momentum Transfer*, **3**, pp. 139-145.

- Keanini, R.G. and Desai, N.N. (1996) "Inverse Finite Element Reduced Mesh Method for Predicting Multi-dimensional Phase Change Boundaries and Nonlinear Solid Phase Heat Transfer," *Int. J. Heat and Mass Transfer*, **39**, pp. 1039-1051.
- Keanini, R.G. and Desai, N.N. (1996) "Inverse-based Reconstruction of Internal Solid-liquid Phase Boundaries and Associated Solid Phase Temperature Fields," *Inverse Problems in Engrg.*, **3**, pp. 93-114.
- Keanini, R.G. and Allgood, C.A. (1996) "Measurement of Time Varying Surface Temperature Fields Using High Frame Rate Visible Imaging CCD Cameras," *Int. Comm. Heat and Mass Transfer*, **23**, pp. 305-314.
- Keanini, R.G. (1995) "Electron Collisionless Layers near Evaporating Plasma-heated Anodes," *Phys. Rev. E*, **52**, pp. 4572-4575.
- Keanini, R.G., Roer, R.D. and Dillaman, R.M. (1995) "A Theoretical Model of Circulatory Interstitial Fluid Flow and Species Transport within Cortical Bone," *J. Biomechanics*, **28**, pp. 901-914.
- Keanini, R.G. (1994) "Thermocapillary, Buoyancy and Shear-driven Flow within Annular Fluid Columns," *Int. J. Heat and Mass Transfer*, **37**, pp. 1579-1591.
- Keanini, R.G. and Rubinsky, B. (1994) "An Inverse Finite Element Minimization -Based Method for Solution of Multi-Dimensional Material- and Phase Boundary Shapes," *Int. J. Num. Meths. Engrg.*, **37**, pp. 1125-1140.
- Keanini, R.G. and Rubinsky, B. (1993) "Three-dimensional Simulation of the Plasma Arc Welding Process," *Int. J. Heat and Mass Transfer*, **36**, pp. 3283-3298.
- Keanini, R.G. (1993) "Simulation of Weld Pool Flow and Capillary Interface Shapes Associated with Plasma Arc Welding," *Finite Elements in Analysis and Design*, **15**, pp. 83-92.
- Keanini, R.G. and Rubinsky, B. (1992) "Optimization of Multi-Probe Cryosurgery," *J. Heat Transfer*, **114**, pp.796-801.
- Keanini, R.G. and Rubinsky, B. (1990) "Plasma Arc Welding Under Normal and Zero Gravity," *Welding J.*, **69**, no. 6, pp.41-50.
- Ortega, J.K.E., Zehr, E. G. and Keanini, R. G. (1989) "In Vivo Creep and Stress Relaxation Experiments to Determine the Wall Extensibility and Yield Threshold for the Sporangiohores of Phycomyces," *Biophysical J.*, **56**, pp.465-475.
- Ortega, J.K.E., Manica, K.J. and Keanini, R.G. (1988) "Phycomyces: Turgor Pressure Behavior During the Light and Avoidance Growth Responses," *Photochemistry and Photobiology*, **48**, pp.697-703.
- Ortega, J.K.E., Keanini, R.G. and Manica, K.J. (1988) "Pressure Probe Technique to Study Transpiration in Phycomyces Sporangiohores," *Plant Physiology*, **87**, pp.11-14.

Book Chapter

- Keanini, R.G., Nortey, T.D., Thorsett-Hill, K., Srivastava, N., Hellman, S., Tkacik, P.T. and Knight, P.D. (2011) "Shock-Induced Turbulent Boundary Layer Separation in Overexpanded Rocket Nozzles: Physics, Models, Random Side Loads, and the Diffusive Character of Stochastic Rocket Ascent," in *Mass Transfer - Advanced Aspects*, ISBN 978-953-307-636-2. InTech Open Access Publishers.

Patent

Apparatus and Method for Creating Dry Underwater Welds, 1999, U.S. Patent No. 5,981,896. (Keanini, Newman, Lowery and Fredericks).

Refereed Conference Proceedings, Poster Presentations, and Abstracts

- Eppes, M.C., Keanini, R. and Hancock, G.S. (2016) "Subcritical crack growth and mechanical weathering: a new consideration of how moisture influences rock erosion rates," European Geosciences Union (EGU) General Assembly Conference Abstracts 18, 10760.
- Keanini, R. and Eppes, M.C. (2016) "Extending non-fatigue Mode I subcritical crack growth data to subcritical fatigue crack growth: Demonstration of the equivalence of the Charles' law and Paris law exponents," European Geosciences Union (EGU) General Assembly Conference Abstracts 18, 11136.
- Eppes, M.C., Magi, B.I. and Keanini, R. (2015) "Real-time observations of rock cracking and weather provide insights into thermal stress-related processes of mechanical weathering," American Geophysical Union (AGU) Fall Meeting Abstracts.
- Mainuddin, M., Keanini, R., and Mullany, B. (2015) "Utilizing small external vibrational sources to increase polishing material removal rates." In ASME 2015 International Manufacturing Science and Engineering Conference, pp. V001T02A002-V001T02A002, American Society of Mechanical Engineers.
- Azimi, F., Fleischhauer, E., Tkacik, P., Keanini, R. and Mullany, B., (2015) "Correlations between media-workpiece contact modes occurring during vibrational finishing and the resulting workpiece topography," presented 15th International Conference on Metrology and Properties of Engineering Surfaces, Charlotte, USA.
- Case, J., Young, M., Keanini, R. and Trammell, S. (2014). "Using LED sources to selectively heat blood for enhanced mid-IR imaging of vascular structures," In Biomedical Optics (pp. BS5A-1). Optical Society of America.
- Ling, X., Cherukuri, H.P. and Keanini, R.G. (2002) "A New Method for the Estimation of Heat Transfer Coefficients in Quenching Problems," 14th US National Congress of Theoretical and Applied Mechanics Proceedings, p. 551.
- Brown, A., Keanini, R., Ruf, J., Reed, D. and D'Agostino, M. (2002) "Characterization of Side Load Phenomena using Measurement of Fluid/Structure Interaction," presented at the 38th Joint Propulsion Conference, AIAA Paper 2002-3999.
- Phan, S., Hocken, R., Smith, S. and Keanini, R.G. (1999) "Resonance-based Force Measurement: Prelude to High-Resolution Anemometry for Liquid Metal Flows," *Proc. ASME Heat Transfer Division - 1999 Vol. 4*, HTD Vol. 364-4, pp. 3-14.
- Keanini, R.G. (1999) "Particle Transport in Quasistatic Stokes Flow," *Proc. ASME Fluids Engineering Division - 1999*, FED Vol. 250, pp. 75-80.
- Johnson, R.E. and Keanini, R.G. (1997) "An Asymptotic Multiple-Time-Scale Model of Work Roll Heat Transfer," in Manufacturing and Materials Processing, ASME Proceedings of the 32nd National Heat Transfer Conference, vol. 9, HTD V. 347, pp. 163-169.
- Keanini, R.G. (1997) "Implicit Reconstruction of Dynamic Three-Dimensional Phase Boundaries," in Inverse Problems in Heat Transfer and Fluid Flow, ASME Proceedings of the 32nd National Heat Transfer Conference, Vol. 2, HTD V. 340, pp. 59-68.

- Saxon, G. B, Kim, R., and Keanini, R.G. (1997) "A Two-Dimensional Model of the Catawba Nuclear Station Service Water Pond During a Hypothetical Accident," in Inverse Problems in Heat Transfer and Fluid Flow, ASME Proceedings of the 32nd National Heat Transfer Conference, Vol. 2, HTD V. 340, pp. 127-133.
- Keanini, R.G. (1996) "Inverse Method for Estimating Surface Heat Flux Distributions during High Speed Rolling," Proc. 1996 Int. Mech. Engrg. Conf. & Expo., ASME MED vol. 4, pp. 339-344.
- Keanini, R.G. and Allgood, C.A. (1996) Measurement of Time Varying Surface Temperature Fields Using Visible Imaging CCD Cameras," Proc. 1996 Int. Mech. Engrg. Conf. & Expo., ASME HTD vol. 332, pp. 239-243.
- Keanini, R.G. and Daily, J.W. (1996) "Chaotic Dynamics Underlying the Acoustically-Convectively Coupled Ramjet Instability," Developments in Theoretical and Applied Mechanics. Proc. 18th South-eastern Conf. Theoretical and Applied Mechanics, pp. 522-535.
- Desai, N.N., Patterson, S., Estrada, H. and Keanini, R.G. (1995) "A Numerical Study of the Effects of Substrate Roughness, Evaporation Rate and Solute Concentration on Coat Smoothness during Spin Coating," in Numerical Methods in Thermal Problems 1995, ed. R. W. Lewis and P. Durbetaki, Pineridge Press, Swansea, U.K., pp. 1136-1146.
- Keanini, R.G. (1995) "Feasibility of Photothermal Deflection Velocimetry in Low-Density Hypersonic Flow," Proc. Fifteenth Canadian Cong. Appl. Mech., pp. 500-501.
- Keanini, R.G. (1995) "Kinetic Analysis of the Electron Knudsen Layer and Plasma Sheath Adjacent Evaporating Plasma Heated Anodes," Proc. Fifteenth Canadian Cong. Appl. Mech., pp. 432-433.
- Keanini, R.G. (1994) "Theoretical Model of Fluid Flow and Species Transport in Porous Cortical Bone," Bull. Amer. Phys. Soc., **39**, p. 1933 (abs).
- Desai, N.N. and Keanini, R.G. (1994) "Planarization of a Spin-Coated Substrate," Bull. Amer. Phys. Soc., **39**, p. 1964 (abs).
- Keanini, R.G. (1994) "Perturbation Solution for Stress-Induced Fluid Flow within Anisotropic Nonhomogeneous Osteons," Proc. 16th Int. Conf. IEEE Engrg. in Medicine and Biology Soc., pp. 293-294.
- Keanini, R.G. (1994) "The Effect of Anisotropic Permeability on Fluid Flow and Species Transport within Cortical Bone," Proc. 16th Int. Conf. IEEE Engrg. in Medicine and Biology Soc., pp.1148-1149.
- Keanini, R.G. (1994) "Cortical Bone Fluid Flow and Species Transport Induced by an Array of Blood Vessels," Proc. 16th Int. Conf. IEEE Engrg. in Medicine and Biology Soc., pp. 1146-1147.
- Keanini, R.G. (1993) "Effect of Micro-architecture on Flow and Species Transport in Cortical Bone, Bull. Amer. Phys. Soc., **38**, p. 2294 (abs).
- Keanini, R.G. (1992) "Perturbation Model of Capillary Surface Shape and Thermocapillary Driven Flow within a Hanging Drop," Bull. Amer. Phys. Soc., **37**, p. 1745 (abs).
- Keanini, R.G. and Rubinsky, B. (1990) "Keyhole and Weld Shapes for Plasma Arc Welding Under Normal and Zero Gravity," in Heat Transfer in Space Systems, ASME HTD-Vol. 135.
- Keanini, R.G. Yu, K. and Daily, J.W. (1989) "Evidence of a Strange Attractor in Ramjet Combustion," AIAA paper 89-0624.
- Yu, K. Trouve, A., Keanini, R.G., Bauwens, L. and Daily, J.W. (1989) "Low frequency Pressure Oscillations in a Model Ramjet Combustor - The Nature of Frequency Selection," AIAA paper 89-0623.
- Ortega, JKE, EG Zehr and RG Keanini (1989) In vivo creep experiments to study extensibility and yield threshold of the cell wall. Fifth Cell Wall Meeting (Edinburgh, UK). Book of Abstracts and Program: 2 (abstract).

- Ortega, JKE, RG Keanini and KJ Manica (1988) Pressure probe technique to study transpiration in single plant cells. Plant Physiology Supplement, 86: 74 (abstract).
- Ortega, JKE, KJ Manica and RG Keanini (1987) Phycomyces: Turgor pressure during the light growth response. Plant Physiology Supplement, 83: 156 (abstract).
- Ortega, JKE and RG Keanini (1987) Phycomyces: Expansion rate vs. changes in turgor pressure. Plant Physiology Supplement, 83: 42 (abstract).
- Keanini, R.G. and Ortega, J.K.E. (1987) "Phycomyces: Turgor Pressure Behavior During the Light and Avoidance Growth Responses," Suppl. Plant Physiology, 83, abstract nos. 252 and 940.

Graduate Student Supervision (with present/last known positions noted)

- Son Phan (Ph.D, Post-doc University of Michigan)
- Derek Overcash (M.S., Oak Ridge National Laboratory)
- Carolyn Genzale (*nee* Dougan) (M.S., Associate Professor, Georgia Tech)
- Karen Thorsett-Hill (Ph.D. 2012, Instructor, UNC Charlotte)
- Thomas Nortey (Ph.D., 2014, Chair, ME Technology Dept., Gaston Community College)
- Tony Martin (Ph.D., 2019 est.)
- John Tomsyk (M.S. 2014, U.S. Army Special Forces)
- Kelly Hannon (M.S., Lockheed Martin)
- Danny Ammons (M.S., Proctor Gamble)
- Justin Thompson (Ph.D. 2005, Dow-Corning)
- Ken Doan (M.S., Frisbee Aerospace)
- Nehal Desai (M.S., Los Alamos National Laboratory)
- Curtis Ayers (M.S., John Deere)
- Greg Saxon (M.S., Duke Power)
- Mark Huffstetler (M.S., Okuma)
- John Kalyanapu (M.S., Catapillar)
- Robert Schweikert (M.S., ANSYS)
- Chris Cope (M.S.; self-employed)
- Chris Allgood (M.S., AMP)
- Matt Warnke (M.S.)
- Dean Pennell (M.S.)
- David DeHart (M.S., TriGen)
- Aravind Arcot (M.S., 2004)
- Courtney Pruette (M.S., 2005, Joe Gibbs Racing)

- Mike McGuire (M.S., 2005, Pace-PME)
 - James (Ty) Miller (M.S., 2005)
 - Vijay Gopalakrishnan (M.S., 2005)
 - Nathan Andreu (M.S., 2006, Areva)
 - Kiran Gona (M.S., 2006)
 - Craig Schmeising (M.S., 2006, Areva)
 - Matt Plante (M.S., 2007 est.)
 - Andrew Huffman (M.S., 2007 est, Areva)
 - Ashish Verma (M.S., 2006 est.)
 - Rigoberto Novamatute (M.S., 2007 est., EPRI)
 - Brandon Tai (M.S., 2008 est.)
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Honors, Awards and Biographical Listings

- Nominee William States Lee College of Engineering Excellence in Teaching Award (Graduate Division), 2012.
 - Nominee William States Lee College of Engineering Excellence in Teaching Award (Graduate Division), 2010.
 - Nominee William States Lee College of Engineering Excellence in Teaching Award (Undergraduate Division), 2006.
 - Oak Ridge Associated Universities Junior Faculty Enhancement Award (Engineering), 1995-96.
 - Research Initiation Grant, Engineering Foundation & American Society of Mechanical Engineers, 1993-94.
 - Finalist, Melosh Medal Competition in Finite Element Analysis, 1993.
 - NASA Graduate Student Researcher Fellowship, NASA, 1988-89.
 - Colorado Scholar, Colorado School of Mines, 1982-83.
 - Who's Who in Science and Engineering, Who's Who in American Education, Who's Who in America
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Teaching and Curriculum Development Activities

- *Development of Graduate Statistical Mechanics Course (ongoing):*
Have been developing a graduate course that combines both statistical physics and quantum mechanics at a level suitable for both advanced engineering grad students and graduate students in physics. Taught Spring, 2013, 2015, 2017.
- *Graduate Curriculum Development (older, but in some courses, ongoing):*
Reorganized graduate level Convective Heat Transfer course emphasizing turbulent transport (2012), Introduced new graduate courses in Advanced Viscous Flow II (2001), Numerical Methods (1995-1998), and Fundamentals of Fluid Flow and Heat Transfer (1995-1998). Reorganized graduate courses in Advanced Viscous Flow I (1994-1998) and Compressible Flow (1995-1998; 2006).

- *Educational Research, Educational Outreach, and Teaching Enhancement Activities (old and discontinued):*
Faculty participant in UNC Charlotte Summer Outreach Program for High School Science and Math Teachers (1993,1994,1996). Faculty participant in Wild Acres Retreat (North Carolina, 1994) and American Society of Engineering Education Symposium (Washington D.C., 1994) on Active Learning Strategies. Coordinated development (as team leader, Thermal-Fluids stem) of undergraduate teaching objectives and measures for meeting ABET accreditation criteria (2001-2003).
- *Undergraduate Lab Development (old and discontinued):*
Developed core undergraduate Mechanical Engineering Thermal-Fluids Lab course; wrote lab manual (available on request); acquired instructional equipment to outfit the lab, (funding from NSF and the College of Engineering); developed tutorials on computational fluid dynamics and error analysis (1995-1998).
- *Human Powered Engineering (old and discontinued):*
Faculty Co-advisor (with Prof. Patterson) to UNC Charlotte's Human Powered Vehicle Team (1998-2003); Co-advisor (with Prof. Hocken) to UNC Charlotte's Human Powered Helicopter Project (2003-present); developed an informal undergraduate course on Human Powered Engineering (2003; rough course notes available on request); organized 2006 East Coast ASME Human Powered Vehicle Competition, UNC Charlotte host.
- *Courses Taught:*
Fluid Mechanics (UG); Thermodynamics I (UG); Thermodynamics II (UG); Thermal-Fluids Laboratory (UG); Intermediate Fluid Mechanics (UG); Human Powered Engineering (UG); Compressible Flow (G); Advanced Fluid Mechanics (G); Advanced Fluid Mechanics II (G); Fundamentals of Fluid Flow and Heat Transfer (G); Numerical Methods in Engineering (G); Convective Heat Transfer (G); Statistical Mechanics.

Research and Education Grants

- "Engaging Military Veterans to Increase STEM Enrollment and Degrees Awarded," 2014-2017 (P.T. Tkacik, K.A. Day, R.G. Keanini, J.H. Lim, P.A. Tolley, M. Uddin), DoD Department of Navy, \$600,000.
- "NASA Student Launch Team Competition," Jan. - June, 2014 (K. Thorsett-Hill, R.G. Keanini), NASA, \$5,000.
- "NASA Student Launch - Senior Design Project," Jan. - June, 2014 (K. Thorsett-Hill, R.G. Keanini), NASA, \$5,000.
- "Hydrokinetic Energy System," 2011-2012 (P.T. Tkacik, M. Uddin, A. Sleiti, M. Evans, R.G. Keanini) Coastal Studies Institute, \$ 47,000.
- "Computational Fluid Dynamic Modeling of the Aerodyn Windtunnel," 2006-2007 (G. K. Watkins, J. Cuttino, R.G. Keanini), Aerodyn Inc., \$ 15,400.
- "Design and Testing of Low Speed Rotors for Human Powered Helicopters," 2004-2005 (R.G. Keanini and H. Estrada), Faculty Research Grant, University of North Carolina at Charlotte, \$ 11,861.
- "Integrated Process Models to Predict Thermal Distortion and Residual Stress," 1999-2003 (H.P. Cherukuri, R.E. Johnson, R.G. Keanini), National Science Foundation, \$ 330,221.
- "The Role of Boundary Layer Separation in Rocket Nozzle Side Loads," 2000-2001 (R.G. Keanini), NASA, Marshall Space Flight Center, \$ 30,000.
- "Development of a High Resolution Resonance-based Anemometer for High Temperature Liquid Metal Flows," 1997-98 (R.G. Keanini, R. Hocken, S.T. Smith), National Science Foundation, \$ 50,000.

"Welding Research Collaboration," 1997-2003 (R.G. Keanini), Electric Power Research Institute, \$ 20,490.

"Development of an Inverse-based Reconstruction Method for Imaging Internal, Unsteady, Optically Opaque Phase Boundaries," 1996-97 (R.G. Keanini), Engineering Foundation and American Society of Mechanical Engineers, \$ 5,000.

"Science Support Grant, Inverse Methods in Materials Processing," 1995-96 (R.G. Keanini), Alcoa Foundation, \$ 7,500.

"Vertical Integration of Just-in-Time Experimentation," 1995-1997 (N. Bodur, H. Estrada, R.G. Keanini), National Science Foundation, \$ 186,710 (includes \$ 83,355 UNC Charlotte matching funds).

"Higher Education Visualization Initiative," 1997 (R.G. Keanini, K.R. Subramanian, J. Raja), North Carolina Supercomputing Center and Cray Research, \$ 10,000 (est., included SGI workstation and training and support at NCSC).

"Oak Ridge Junior Faculty Enhancement Award," 1995-96 (R.G. Keanini), Oak Ridge Associated Universities, \$ 10,000 (includes \$ 5,000 University match).

"Welding Research Development," 1995 (R.G. Keanini), College of Engineering, UNC Charlotte, \$ 24,900.

"Summer Outreach for Secondary Science and Math Teachers," 1995 (G. Mohanty, P. DeHoff, R. Janardhanam, Y. Kakad, R. G. Keanini), Eisenhower Foundation, \$ 35,000.

"Welding Equipment Donation," 1995 (R.G. Keanini), Electric Power Research Institute, \$ 2,500.

"Numerical and Experimental Investigation of Fluid Interaction with Aortic Heart Valves," 1995 (R.G. Keanini) Carolinas Medical Center, \$ 3,000.

"Travel Grant - Canadian Congress Applied Mechanics," 1995 (R.G. Keanini), College of Engineering, UNC Charlotte, \$ 750.

"Engineering Research Initiation Grant," 1993-94 (R.G. Keanini), Engineering Foundation and American Society of Mechanical Engineers, \$ 17,400.

"Cray Research Grant Optimization of Multi-Probe Cryosurgery," 1994 (R.G. Keanini), \$ 44,500 (includes \$ 7,000 Cray Graduate Student Fellowship and \$ 37,500 computer time at the North Carolina Supercomputing Center).

"Development of Welding Research Laboratory," 1994 (R.G. Keanini), Engineering Research Grant, College of Engineering, UNC Charlotte, \$ 9,000.

"Variable Polarity Plasma Arc Welder Equipment Donation," 1994 (R.G. Keanini), Hobart Welding, \$ 69,000.

"Inverse Solution for Three-Dimensional Phase Change Boundaries and Material Temperature Fields," 1993-94 (R.G. Keanini), North Carolina Supercomputing Center, \$ 5,000 (computer time).

"Faculty Development Grant: Pilot Development of an Ultrasonic-Imaging Cryoprobe," 1993 (R.G. Keanini and H. Estrada), University of North Carolina at Charlotte, \$ 8,600.

"Modeling Flow and Species Transport in Cortical Bone," 1993-94 (R.G. Keanini), North Carolina Supercomputing Center, \$ 40,000 (computer time).

Research and Industrial Collaboration

- *Rocket Research - University of North Carolina at Charlotte and Mitchell Aerospace (2009-present):*
Using experimental, numerical, and theoretical approaches to study the dynamic response of rock-

ets under various stochastic loads; investigating shock-boundary layer interactions in high pressure ratio rocket nozzles. Presently, two graduate students, several undergraduates, and five faculty are participating.

- *ISERRT (2011-present):*
Modeling the interaction between blast loads and various structures and structural elements. This collaboration is based in the Department of Civil Engineering, UNC Charlotte, under Professor David Weggel. The collaboration employs a variety of experimental, numerical, and theoretical approaches for studying blast physics and blast-structure interactions.
- *Electric Power Research Institute (1994-2003):*
Work was focused on welding-related research. Starting in 1998, three Masters students were supported through tuition waivers and part-time (academic year) and full-time summer work at EPRI. Two masters degree projects and a U.S. Patent ["Apparatus and Method for Creating Dry Underwater Welds," Keanini et al., No. 5,981,896 (1999)] resulted from the collaboration.
- *Baylor College of Dentistry - Department of Biomaterials (1994-2006):*
Work is focused in the areas of dental materials and process modeling; three journal articles have resulted from this collaboration.
- *University of North Carolina at Wilmington - Department of Biology (1994-1996):*
Work was focused on modeling fluid flow and solute transport in cortical bone; a journal paper and three conference proceedings were published.
- *University of North Carolina at Charlotte - Department of Mechanical Engineering & Engineering Science (1994-present):*
Collaborations have been established with a number of ME faculty, including Drs. Cherukuri, Hocken, Johnson, Smith, Patterson, Lawton, Estrada, and Kim (ret.), resulting in seven journal and five conference publications.
- *Carolinas Medical Center (1994-1996):*
Work was in the area of measuring prosthetic heart valve function.

Service/Organizing Activities

Organizing Committee, SIAM Annual Meeting, Southeast Section, 2011
Organizer ASME Human Powered Vehicle Competition (East Coast), 2006

Society Membership

American Physical Society
American Society of Mechanical Engineers
Society for Industrial and Applied Mathematics
