



Kate Hadley Baker's career has spanned many areas among the geoscience and engineering disciplines, including geotechnical, drilling, reservoir engineering, geology, geophysics, and formation evaluation. She started at Exxon Production Research Company (EPR), working as a research geologist, becoming supervisory geologist in the Reservoir Description Section. She then moved from senior to district geologist positions in Exxon's Offshore Division, ultimately heading formation evaluation and well testing at Exxon

Company USA before returning to EPR. She was recruited away, and held various managerial roles at BP and its related companies, including Manager of Amoco's tight gas resources in Wyoming and CIO of ARCO during the Y2K transition. She retired from BP as a distinguished advisor and director of new well delivery in BP's Upstream Technology Function, serving also during 2009-10 as Vann Fellow to Princeton University.

Baker was the 2004 President of the Society of Petroleum Engineers, and is past president of the SPE Foundation. Among many professional volunteer positions, she chaired the US National Committee for Rock Mechanics, the Interagency Continental Scientific Drilling Committee, and most recently the annual peer reviews for the US DOE Geothermal Technologies Program Office, and held the post of secretary of the American Rock Mechanics Association from 2013-2019. In her association with SPE, Baker is proudest of helping nurture it as an international organization, as a participant in the digital age, and as custodian of international reserves and resources definitions. She earned a B.S. degree in geology and a Ph.D. in geophysics — both from the Massachusetts Institute of Technology.



Antonio Bobet is Professor of Civil Engineering at Purdue University. He is also a Guest Professor and Visiting Chair Professor of the Innovation Center for Disaster Prevention at the School of Civil Engineering, Tongji University, China. He has extensive experience in practice. He was senior geotechnical engineer at Euroestudios, consulting engineers, in Spain and construction manager at Ferrovial, Spain. Bobet's areas of interest include rock fracture mechanics, underground structures and wave propagation through fractured media.

He holds a bachelor's and master's degrees in Civil Engineering from Technical University of Madrid in Spain and a Doctor of Science degree from the Massachusetts Institute of Technology. He has authored

or co-authored more than one hundred technical publications. He serves or has served on the Editorial Board of a number of Journals. He is the Co-Editor in Chief of *Underground Space*. He was elected member of the Board of Directors of ARMA in 2009, and served as its President from 2013 to 2015. He was the Chair of the 2012 US Rock Mechanics/Geomechanics Symposium and is a member of the Geotechnical Advisory Board (GAB) of the Panama Canal. He was appointed a High-end Foreign Expert by the Government of China in 2016.

Bobet has received a number of awards, including the ASCE 2011 Ralph B. Peck Award, the 2012 National Award for Significant Contributions in Science and Technology - SENACYT Panama, and the 2012 ARMA Research Award.



Bill Dershowitz is best known as the author of FracMan®, a leading commercial discrete fracture network (DFN) model. He worked for Golder Associates for almost 40 years, and has taught Rock Mechanics, Engineering Geology, and Hydrogeology at the University of Washington since 1993. He has also served as visiting faculty at Weizmann Institute of Science, Ben Gurion University of the Negev, and Hebrew University. Dr Dershowitz pioneers applications of the DFN approach for slope, mine and tunnel stability, dam foundations, geothermal, oil/gas, mining, hydrogeology, and environmental applications, including radioactive waste repository development. His work integrates principles of geology, structural geology, geophysics, hydrodynamics, and geomechanics to provide practical solutions for those engineering problems that require an understanding of the effects of discrete fractures. He is also active in development of approaches for hydrogeological optimization and uncertainty analysis for fractured and heterogeneous aquifers, and is the author of over 100 professional papers and reports. Dr. Dershowitz earned a B.S. in Geotechnical Engineering and an M.S. and Ph.D. in civil engineering (rock mechanics) from Professors Einstein and Baecher at the Massachusetts Institute of Technology. He has been active in ARMA his entire professional career, and has served on the ARMA and ARMA foundation boards.



Emmanuel Detournay is currently the Theodore W Bennett Chair Professor in Mining Engineering and Rock Mechanics in the Department of Civil, Environmental, and Geo-Engineering of the University of Minnesota (UMN)/ He holds a mining engineering degree from the University of Liège, Belgium and MSc and PhD degrees in Geoengineering from the UMN. Prior to joining the UMN in 1993 as a

faculty, he held various positions in consulting companies (Itasca, Minneapolis, MN; Agbabian Associates, El Segundo, CA) and in R&D (Dowell-Schlumberger, Tulsa, OK; Schlumberger, Cambridge, England). His expertise is in petroleum geomechanics, with two current research focuses: drilling mechanics (bit/rock interaction, self-excited drilling vibrations, drillstring/borehole interaction, and directional drilling) and mechanics of fluid-driven fractures (asymptotic analysis, scaling, numerical modeling). He has co-authored about 100 papers in refereed publications and also about 100 conference papers. He also been awarded 6 US patents and has received several scientific awards for his work. In 2016 he was elected into the US National Academy of Engineering (Foreign Member)



Charles H. Dowding is Professor of Civil and Environmental Engineering at Northwestern University with a B.S. from the University of Colorado, Ph.D. from the University of Illinois, post doc at the Norwegian Geotechnical Institute, assistant professorship at MIT. He is best known for his four books: 1. Construction Vibrations, 2. Blast Vibration Monitoring and Control, 3. Micro-Meter Crack Response to Vibration, and 4. Weather and GeoMeasurements by Pulsing TDR Cables and Probes.

He is a former member of the board of directors of the International Society of Explosive Engineers and founded Digital Vibration Inc. formerly of Northbrook, the first company to perfect remote digital blast vibration monitoring in the early 1980's. Along with coauthors, he received the Applied Research Award from the US National Committee for Rock Mechanics for work on blast induced cracking of structures that serves as the basis of federal regulations (US Bureau of Mines, RI 8507). He is a former chairman of the ASCE Rock Mechanics Committee, and former member of the board of directors of the American Rock Mechanics Association.

His consulting engagements have involved projects in Canada, Panama, Hong Kong, Italy and some 30 of the United States. He has consulted for many governmental agencies including the US National Park Service, US Department of Transportation, US Department of Energy, and companies, including IBM, MWH, Stone & Webster, Sargent & Lundy, CH2MHill, Shell, and Fina Oil.



Maurice Dusseault teaches Geological Engineering in the Earth and Environmental Sciences Department of the University of Waterloo in Ontario, Canada. He left his first attempt at University in early 1965 to work in Alberta as a roughneck on drilling rigs, then as a drilling fluids technician. On the advice of his future wife, he returned to complete a B.Sc. in Civil Engineering in 1971, and, after a year of travel, curling and field geology, he entered a Ph.D. program at the University of Alberta, graduating in 1977 from Civil Engineering with a thesis on the Geotechnical Properties of the Athabasca Oil Sands. He was awarded a five-year special professorship in Alberta, and became a full professor in

1982, when he moved to the University of Waterloo to steer the Geological Engineering Program. He went on half-time in 1998 to work more closely with industry as a teacher and advisor, but remains actively teaching and developing new courses in geothermal energy and THM geomechanics.

Dusseault's research is in deep underground engineering issues including oil production, hydraulic fracturing, energy storage, geothermal energy, carbon sequestration, and deep injection disposal of granular solids and liquid wastes (including biosolids, oilfield wastes, and civil wastes). He holds over 90 international patents, has about 570 full-text papers published in journals and conferences, and has taught industry-oriented geomechanics short courses in 28 countries. He is involved in energy technologies that can be downscaled to community levels to provide robust and reliable heat and power: geothermal heat mining, natural gas approaches, compressed air energy storage, and heat geostorage. Many of the general energy processes on which he works involve hydraulic fracture implementation to generate communication, or analysis to prevent hydraulic fracturing onset.



Herbert H. Einstein, Professor Civil and Environmental Engineering at the Massachusetts Institute of Technology, received his degree in civil engineering from ETH-Zürich. His teaching and research areas are underground construction, rock mechanics and engineering geology. Einstein has been involved as an advisor, consultant and researcher in issues related to underground construction, rock mechanics and rock engineering and natural hazards, notably landslides, and in waste repository problems. He has been and is a member of a number of national and international technical/scientific committees and advisory boards; he is also co-editor of the journal, *Rock Mechanics*

and *Rock Engineering*, and a member of the editorial boards of *Tunneling and Underground Space Technology* and of *Engineering Geology*. Einstein is author or co-author of over 300 publications in his area of expertise. He was the recipient of the prestigious Müller lecture award of the International Society for Rock Mechanics and of the "Outstanding Contributions to Rock Mechanics" award of the American Rock Mechanics Association. He also received several teaching awards from his Department and from the School of Engineering.



Derek Elsworth is Professor in the Departments of Energy and Mineral Engineering and of Geosciences and the Center for Geomechanics, Geofluids, and Geohazards at Penn State University. His interests are in the areas of computational mechanics, rock mechanics, and in the mechanical and transport characteristics of fractured rocks, with application to geothermal energy, the deep geological sequestration of radioactive wastes and of CO₂, unconventional hydrocarbons including coal-gas, tight-gas-shales and hydrates, and instability and eruption dynamics of volcanoes. Elsworth is a member of the US

National Academy of Engineering.



Charles Fairhurst is Professor Emeritus, University of Minnesota and Senior Consultant, Itasca Consulting Group in Minneapolis. He obtained his Ph.D. in Mining Engineering from the University of Sheffield, UK in 1955. He joined the University of Minnesota faculty, School of Mines and Metallurgy in 1956, serving as Head for several years to 1970, when the Mining program was joined with Civil Engineering to form the Department of Civil and Mineral Engineering. He was Head of the joint Department from 1973-87, and retired in 1997.

He has consulted on rock stability problems for tunnels, dams, mines and excavations throughout the world. He remains active in consulting, with a current emphasis on the mechanics of fracture propagation in naturally fractured rock and the effective stimulation of geothermal reservoirs. He served as President of the International Society for Rock Mechanics (ISRM) 1991-1995 and is a Fellow of ISRM, and has been elected to the Royal Swedish Academy of Engineering Sciences (1979) and the US National Academy of Engineering (1991).

Fairhurst holds honorary doctorate degrees from the University of Nancy, France; St. Petersburg Mining Academy, Russia; University of Sheffield, England; and University of Minnesota, USA; and is Advisory Professor to Tongji University, Shanghai, China. In December, 2013, he was inducted as Officier, Légion d'Honneur, France. In February 2018, Fairhurst received the Society of Mining, Metallurgy and Exploration (SME) President's Citation Award "... for outstanding contributions to the science and technology of Rock Mechanics which is fundamentally integral to SME's multiple disciplines." He serves as Chair of Section 11 (Earth Resources Engineering) of the US National Academy of Engineering from July 1, 2018 - June 30, 2019.



Steven D. Glaser is Professor of Civil and Environmental Engineering at the University of California, Berkeley, distinguished affiliate professor at the Technical University of Munich, and a research scientist at the Lawrence Berkeley National Laboratory. Glaser's engineering training was at The University of Texas at Austin. He also has a B.A. in philosophy from Clark University, 1975. He completed the apprentice program of Local 77 of the International Union of Operating Engineers, following which Glaser worked eight years as a driller, including one

year in Iraq.

Glaser's rock mechanics research centers on the use of nanoseismicity to explore the fracture behavior of rock, and the physical mechanism of friction. His absolutely calibrated nanoseismic displacement sensors allow the usage of quantitative seismic methods to acoustic emission studies. He has examined the use of CO₂ as the heat carrying fluid of EGS, and is currently working on injection-induced seismicity in hot rock. In addition, Glaser has worked on design and application of wireless sensor networks, from seismic safety of wood-frame houses to measuring the seismic response of the Masada Mountain in Israel to measuring environmental hazards at Chinese historical sites such as Dunhuang and the Yingxian Wooden Pagoda. He currently operates the world's largest wireless sensor network in the Sierra Nevada Mountains in California.



Richard Goodman is the Cahill Professor of Geotechnical Engineering Emeritus, University of California, Berkeley. He was elected to the US National Academy of Engineering in 1991. Goodman is the author of five books on geological engineering, rock mechanics, engineering geology and a biography of Karl Terzaghi. He is the first recipient of ARMA's Distinguished Lecture in 2016. Goodman's research interests include keyblock theory, characterization and analysis of

discontinuous rocks, and rock mechanics. His research in applied rock mechanics led to development of the joint element for finite element analysis (with Robert Taylor), introduction of the base friction model test, and the development of block theory. He received his B.A. Geology from Cornell University in 1955, his M.S. Civil Engineering and Economic Geology from Cornell University 1958, and his Ph.D. Geological Engineering, University of California, Berkeley in 1963.



Sidney Green is founder and president of Enhanced Production, Inc., and is Research Professor at the University of Utah where he holds an appointment in Mechanical Engineering. He is a retired senior member of Schlumberger and is a founder and past president of TerraTek, which was acquired by Schlumberger in 2006. He has worked for over five decades in the field of geomechanics/rock mechanics and has published many papers, holds a number of patents, and has given many invited presentations. He has served as director for a number of companies, has served on government committees and university

advisory boards, and has testified at Congressional hearings. He has served on the Utah Science Council and was a director and chair of the Utah Technology Finance Corporation, and has recently served on the National Research Council/National Academies committees on Destruction of Chemical Weapons, Committee for Methane Hydrates as an Energy Resource, and Committee for Induced Seismicity from Energy Recovery. Green has a B.S. and M.S. in Mechanical Engineering. He attended the University of Pennsylvania and Stanford graduate schools receiving a degree of Engineering Mechanics from Stanford University. He received the Outstanding Engineer award for the State of Utah and Entrepreneur of the Year from the Mountain West Venture Group, the Professional Engineer Award from Missouri School of Mines, and the Honorary Alumni Award from the University of Utah. He is a past member of the Greater Salt Lake Chamber of Commerce Board of Governors. He is a member of the US National Academy of Engineering.



Bezalel C. Haimson is Professor Emeritus of Geological Engineering, University of Wisconsin, Madison. He received his Ph.D. degree in 1968 from University of Minnesota, under the supervision of Professor Charles Fairhurst. After establishing the rock mechanics/hydraulic fracturing laboratory at Halliburton Services in Duncan, Oklahoma, he joined the University of Wisconsin in 1969, and has been there ever since.

In his Ph.D. thesis, Haimson developed the poroelastic relationships between hydraulic fracturing (HF) pressures and in-situ principal stresses (1968). In 1971 he conducted the first field HF measurements of in-situ stress, in a wellbore at Rangely, Colorado (induced seismicity research). This was followed by the first underground HF measurements in the Sierra Nevada Mountains (underground pumped storage), and the deepest HF tests (the Michigan 5000 m ultra-deep well), among others. The success of these initial tests paved the way for the worldwide acceptance and adaptation of HF as an in-situ stress measuring technique at any depth below the surface. Haimson is also credited with promoting the laboratory method of “true triaxial testing” of rock as superior to the more established conventional triaxial testing.

Haimson has received the 2006 American Rock Mechanics Association Award for Research in Rock Mechanics, the 2000 US National Committee for Rock Mechanics Applied Research Award, the 1997 Society of Mining, Metallurgy and Exploration (SME) Rock Mechanics Award for the development of hydraulic fracturing as an engineering method of in-situ stress measurement, the 1975 American Society for Testing and Materials (ASTM) Award for contributions to rocks and soils mechanics, and the 1970 US National Committee on Rock Mechanics Research Award in recognition for research achievements in rock mechanics (development of the hydraulic fracturing stress measurement method). He is the editor of three books on rock mechanics, and the author of over 200 professional papers. Haimson has served as Editor-in-Chief of the ARMA Letters (formerly ARMA e-Newsletter) since its inception in 2010.



John McLennan has been Professor in the Department of Chemical Engineering at the University of Utah since October 2009. He has been a Senior Research Scientist at the Energy and Geoscience Institute and an Adjunct Professor in the Department of Civil Engineering at the University of Utah since January 2008. He has a Ph.D. in Civil Engineering from the University of Toronto, awarded in 1980. He has more than thirty-five years of experience with petroleum service and technology companies. He worked nine years for Dowell Schlumberger in their Denver, Tulsa and Houston facilities. Later, he was with TerraTek in Salt Lake City, Advantek International in Houston, and ASRC Energy Services in Anchorage. He has worked on projects concerned with subsurface energy recovery (hydrocarbon, geothermal) in a variety of reservoir environments, throughout the world. McLennan served as President of ARMA from 2015-2017.

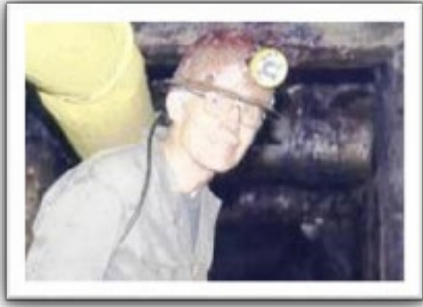


Priscilla P. Nelson is Professor and Head of Mining Engineering at the Colorado School of Mines. She previously was Provost at the New Jersey Institute of Technology (NJIT), program director and senior advisor at the US National Science Foundation (NSF), and Professor in Civil Engineering at The University of Texas at Austin. She has an international reputation in geological and rock engineering, and has been involved in the underground construction industry for over 35 years. She worked for the

US DOE and the State of Texas on the Superconducting Super Collider project, and she has served two terms on the US Nuclear Waste Technical Review Board, appointed by President Clinton.

Nelson has published more than 150 technical and scientific publications, and she is a Distinguished Member of the American Society of Civil Engineers (ASCE), former president of the Geo-Institute of ASCE, a lifetime member and first president and Fellow of the American Rock Mechanics Association, and Fellow of American Association for the Advancement of Science (AAAS). Nelson has received many honors and awards, including election to The Moles (1995) and induction into Tau Beta Pi as an Eminent Engineer (2007). In 2008 she received the Kenneth Andrew Roe Award from the American Association of Engineering Societies (AAES), and she was the 2011 recipient of the ASCE Henry L. Michel Award. In 2015 she was identified as one of the 100 Global Inspirational Women in Mining (by WIM/UK), and also was appointed to the Committee on Geological and Geotechnical Engineering of the National Academies. In 2016 she was appointed Chair of the Mine Safety and Health Research Advisory Committee of NIOSH/CDC. In 2018 she received the Outstanding Educator award from Underground Construction Association of SME.

She received her BS degree in geology from the University of Rochester (1970) and two master's degrees in geology (Indiana University, 1976) and structural engineering (University of Oklahoma, 1979). In 1983, she received her PhD degree from Cornell University.



Bill Pariseau obtained his B.S. degree in Mining Engineering at the University of Washington, Seattle, following the geological option and subsequently earned a Ph.D. in Mining Engineering at the University of Minnesota with emphasis on rock mechanics and with a minor in applied mathematics. Prior to his Ph.D., he obtained practical experience working for the City of Anchorage, the Alaska Department of Highways, the

Mineral Resources Division of the US Bureau of Mines (Spokane), the Anaconda Copper Co. in Butte, Montana, and the New York-Alaska Gold Dredging Corp. in Nyc, Alaska. He served in the US Marine Corps (1953-1956). He maintained a strong association with the former US Bureau of Mines, first with the Pittsburgh Mining Research Center and later with the Spokane Mining Research Center. He is a registered professional engineer and has consulted for a number of commercial and government entities.

Currently, Pariseau is Professor Emeritus and former holder of the Malcolm McKinnon Endowed Chair in Mining Engineering at the University of Utah. He joined the Department in 1971 following academic appointments at the Montana College of Science and Technology and the Pennsylvania State University. He has been a visiting academic at Brown University, Imperial College, London, and at the Commonwealth Science and Industrial Research Organization (CSIRO), Australia. He and colleagues have received a number of rock mechanics awards; he was recognized as a distinguished university research professor at the University of Utah in 1991. In 2010, he was recognized for teaching in the College of Mines and Earth Sciences with the Outstanding Faculty Teaching Award. The same year, he was honored by the Old Timers Club with their prestigious Educator Award. He published the first-ever text book for undergraduates, *Design Analysis in Rock Mechanics*, a commercial success in 2007 that is now in a second edition.

Bill remains active with current research focused on the mechanics of equivalent properties jointed rock masses, the role of natural variability in rock masses, and on questions of multiple scales in rock mechanics and mine-induced seismicity. He keeps in touch with students, past and present, who often drop by to say hello and talk rock mechanics.



Laura J. Pyrak-Nolte is a Distinguished Professor of Physics and Astronomy in the Department of Physics and Astronomy, College of Science, at Purdue University. She holds courtesy appointments in the Lyle School of Civil Engineering and in the Department of Earth, Atmospheric and Planetary Sciences, also in the College of Science. Prior to arriving at Purdue in 1997, she was an Assistant Professor at the University of Notre Dame in the Department of Civil Engineering and Geological Sciences. Pyrak-Nolte holds a B.S. in Engineering Science from the State University of New York at Buffalo, an M.S. in Geophysics from Virginia Polytechnic Institute and State

University, and a Ph.D. in Materials Science and Mineral Engineering from the University of California, Berkeley. Her interests include applied geophysics, experimental and theoretical seismic wave propagation, rock mechanics, micro-fluidics, particle swarms, machine learning applied to geophysical signals, and fluid flow through earth materials. In 1995, Pyrak-Nolte received the Schlumberger Lecture Award from the International Society of Rock Mechanics. She received Young Investigator Awards from the National Science Foundation and the Office of Naval Research, and in 2001, Purdue recognized Pyrak-Nolte's accomplishments with a University Scholar Award. In 2012, she was appointed to the Department of Energy's Earth Sciences Council and to the Council for the International Society of Porous Media. In 2015, she was appointed to the Department of Energy, Office of Basic Energy Sciences, Council on Chemical Sciences, Geosciences and Biosciences. She served as President of ARMA, 2017-2019.

Pyrak-Nolte has been involved in the Rock Mechanics community since 1987 and with ARMA since 1994. She has participated in conferences, has chaired or co-chaired technical sessions and has provided service as a reviewer to the organization of symposia. She was on the organizing committee for the 2012 meeting in Chicago and is the chair for the 2013 Symposium in San Francisco.



John Rudnicki is Professor of Civil and Environmental Engineering and Mechanical Engineering at Northwestern University. He earned his Bachelor's (1973), Master's (1974), and Ph.D. (1977) degrees from Brown University. After a postdoctoral fellowship in Geophysics at Caltech, he became Assistant Professor in the Department of Theoretical and Applied Mechanics at the University of Illinois in 1978. In 1981, he moved to Northwestern University.

Professor Rudnicki's research has been the area of inelastic behavior and failure of geomaterials. He has been especially interested in deformation instabilities and the effects of coupling between deformation and fluid diffusion with applications to fault instability, quantification of energy radiation from earthquakes and environment- and resource-related geomechanics.

He is a Fellow of American Society of Mechanical Engineers and the Engineering Mechanics Institute. He received the Maurice A. Biot Medal (ASCE), the Daniel C. Drucker Medal (ASME), the Brown Alumni Engineering Medal, and the Society of Engineering Science Medal. He has held a variety of editorial and committee assignments including chairman of the Geosciences Council for the Department of Energy Basic Energy Sciences and a member of Advisory Council of the Southern California Earthquake Center.



Wolfgang Wawersik received a Dipl.-Ing. degree in mining engineering from the Technische Hochschule Aachen, Germany, and M.S. and Ph.D. degrees in mineral engineering/rock mechanics from the University of Minnesota. He gained early professional experience in the German and British mining industries. After Minnesota, he held positions at the Massachusetts Institute of Technology, University of Utah, Sandia National Laboratories, and the US Department of Energy/Office of Basic Energy Sciences.

Wawersik's research focused on experimental geomechanics to characterize pre- and post-failure rock response, measure rock properties, and validate design procedures for underground structures. His work included the characterization of rock salt and stress measurements for geologic storage projects.



Mark Zoback is the Benjamin M. Page Professor of Geophysics and the Director of the Stanford Natural Gas Initiative at Stanford University. He co-directs SCITS Stanford Center for Induced and Triggered Seismicity (SCITS). Conducting research on in-situ stress, fault mechanics, and reservoir geomechanics, Zoback is the author of a textbook, *Reservoir Geomechanics*, published in 2007 by Cambridge University Press, the author/co-author of 400 technical papers and holder of five patents. His online course, *Reservoir Geomechanics*, has been completed by over 8,000 students around the world. Zoback has received a number of

awards and honors, including the Robert R. Berg Outstanding Research Award of the AAPG in 2015 and the Outstanding Contribution to the Public Understanding of the Geosciences Award from AGI in 2016. A member of the US National Academy of Engineering, he served on the academy's committee investigating the Deepwater Horizon accident and the Secretary of Energy's committee on shale gas development and environmental protection.