

STRUCTURAL HEALTH MONITORING USING STATISTICAL PATTERN RECOGNITION

Instructors:

Charles R. (Chuck) Farrar, Ph. D., PE (farrar@la-dynamics.com)

Chuck Farrar is the President of Los Alamos Dynamics. Chuck Farrar has over 30 years of experience at Los Alamos National Laboratory (LANL). He is currently the director of LANL's Engineering Institute. While at LANL, he earned a Ph.D. in civil engineering from the University of New Mexico in 1988. The first ten years of his LANL career focused on performing experimental and analytical structural dynamics studies for a wide variety of systems including nuclear power plant structures subject to seismic loading, and weapons components subject to various portions of their stockpile-to-target loading environments. Currently, his research interests focus on developing integrated hardware and software solutions to structural health monitoring problems and the development of damage prognosis technology. The results of this research have been documented in over 300 refereed journal articles, book chapters, conference papers, Los Alamos reports, numerous keynote lectures at international conferences, and most recently in a book co-authored with Prof. Keith Worden entitled *Structural Health Monitoring A Machine Learning Perspective*. In 2000 he founded the Los Alamos Dynamics Summer School. His work has been recognized at LANL through his reception of the inaugural Los Alamos Fellows Prize for Technical Leadership and by the Structural Health Monitoring community through the reception of the inaugural Lifetime Achievement Award in Structural Health Monitoring. He is currently working jointly with engineering faculty at University of California, San Diego to develop the Los Alamos/UCSD Engineering Institute. This initiative is also developing a formal, degree-granting educational program in the closely related areas of validated simulations and structural health monitoring. Additional professional activities include an associated editor position for *Earthquake Engineering and Structural Dynamics*, and the development of this short course that has been offered 37 times in association with conferences and to industry and government agencies in Asia, Australia, Europe and the U.S. He is a Fellow of the American Society of Mechanical Engineers, American Society of Civil Engineers, Society for Experimental Mechanics and a Los Alamos National Laboratory Fellow.



Michael Todd, Ph. D. (mdtodd@ucsd.edu)

Mike received his B.S.E. (1992), M.S. (1993), and Ph.D. (1996) from Duke University's Department of Mechanical Engineering and Materials Science, where he was an NSF Graduate Research Fellow. In 1996, he began as an A.S.E.E. post-doctoral fellow, then a staff research engineer (1998), and finally Section Head (2000) at the United States Naval Research Laboratory in the Fiber Optic Smart Structures Section. He joined the Structural Engineering Department at the University of California San Diego in 2003, where he currently serves as Professor of Structural Engineering. To date, he has published 120+ journal papers, four book chapters, over 250 conference papers and proceedings, and has 4 patents. His main research areas are in applying nonlinear time series techniques (such as chaotic interrogation) to vibration-based structural health



monitoring, ultrasonics, uncertainty quantification, building UAV-enabled RFID sensing systems for structural assessment, developing real-time shape reconstruction strategies for highly flexible structural systems, designing and testing fiber optic measurement systems, and developing noise propagation models for fiber optic measurement systems. With partners at Los Alamos National Laboratory, he helped create the country's first graduate degree program in structural health monitoring, damage prognosis, and validated simulations at UCSD, and he serves as Campus Director of the associated Engineering Institute. He has won the 1999 Alan Berman NRL Publication Award, the 2003 and 2004 NRL Patent Award, was a 2004-2005 UCSD Hellman Fellow, was an invited speaker at the 2003 National Academy of Engineering Japan-America Frontiers of Engineering Symposium where he was runner-up for the Galbraith Distinguished Lectureship, was nominated for the 2005 SEM Durelli Award, was named to 2005 Academic Keys' 'Who's Who in Engineering Education,' was an invited speaker for the 2005 SOM National Building Science and Design Research Symposium in New York, and was a 2004 William J. Von Leibig Center for Entrepreneurism and Technology Advancement fellowship winner. He won the 2005 Structural Health Monitoring Person-of-the-Year Award, presented at Stanford University in September 2005, he was a 2009 Benjamin F Meaker Visiting Fellow at the University of Bristol (UK), and he won the 2016 Society of Experimental Mechanics DeMichele Award for excellence in mechanics education and research. He also serves as the Managing Editor of *Structural Health Monitoring: An International Journal*.

Eric B. Flynn, Ph.D. (ericbflynn@gmail.com)

Eric Flynn is an R&D Engineer in the Intelligence and Space Research Division at Los Alamos National Laboratory in the United States. He completed his Ph.D. in Structural Engineering at the University of California, San Diego in 2010 as a National Science Foundation Graduate Research Fellow following his masters and bachelors studies in Engineering at Caltech and Harvey Mudd College. During his PhD, Eric invented a new Bayesian statistics framework for designing SHM systems and was the lead developer of the SHMTools software package, a widely-used tool among SHM researchers. Prior to joining Los Alamos, Eric served as the Structural Health Monitoring Lead at Metis Design, a technology leader in the development of aerospace structural monitoring systems, and he still serves as a regular consultant for the company. His current research areas include ultrasonic non-destructive inspection and structural health monitoring as well as design optimization of surveillance and monitoring systems. Eric has authored over 50 publications in structural health monitoring, holds a US patent in the field. He received a 2014 R&D 100 Award for his technology breakthroughs in ultrasonic guided-wave-based inspection and a second R&D 100 Award in 2015 for the SHMTools Software. His ultrasonic guided wave technology was also selected for the 2017 Los Alamos Fellows Prize in Science and Engineering. Eric has served as an instructor for the Los Alamos Dynamics Short Course for the last five years.

