

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 30 years of experience as a technical staff member, project leader, and team leader at Los Alamos National Laboratory. He is currently the director of The Engineering Institute at Los Alamos National Laboratory. While at Los Alamos, he earned a Ph.D. in civil engineering from the University of New Mexico in 1988. The first ten years of his career at LANL 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 recently been recognized at Los Alamos 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 more than 25 times to industry and government agencies in Asia, Australia, Europe and the U.S. In January of 2007 he was elected to Fellow of the American Society of Mechanical Engineers and in 2012 he was elected as a Fellow of Los Alamos National Laboratory.

Michael Todd, Ph. D. (mtdodd@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 Associate Professor. To date, he has published 80+ journal papers, four book chapters, over 160 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, 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 subsequent 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, and he was a 2009 Benjamin F Meaker Visiting Fellow at the University of Bristol (UK). He also serves on the editorial board of Structural Health Monitoring: An International Journal.

Keith Worden Ph.D. CEng (k.worden@sheffield.ac.uk)

Keith, based in the Department of Mechanical Engineering at the University of Sheffield, UK, has over 25 years of experience of research in structural dynamics with an emphasis on signal processing and interpretation. He has held a UK EPSRC Advanced Fellowship on *A Holistic Approach to Damage Identification* and currently holds an EPSRC Established Career Fellowship on *Disease Surveillance in Systems and Structures*. He is the author or co-author of three books and around 500 journal and conference papers. He is a member of the EPSRC peer review college and sits on the editorial board of two international journals. In the past he has been coordinator of the EU COST F3 action on Structural Dynamics working group WG2 on Structural Health Monitoring (SHM), and was an initiator of the EPSRC network on Structural Integrity and Damage Assessment (SIDANET). Keith was also PI on the recently-completed project *Smart Sensing for Structural Health Monitoring (S3HM)* which was coordinated by the European Research Council and brought together leading European researchers in the field of vibration-based SHM. Keith is a Fellow of the Institute of Physics, the Institute of Mathematics and its Applications, and the Institution of Mechanical Engineers. He was jointly awarded *Person of the Year 2004* by the International Journal of SHM for his work on structural health monitoring.

