



Ben Franklin
Technology PARTners
Central and Northern Pennsylvania



Structural Health Monitoring

Short Course

8-10 July 2008

Penn State University
University Park, Pennsylvania

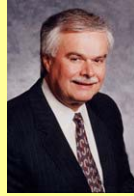
An excellent opportunity for Aerospace, Mechanical, and Civil Engineers to learn about:

- SHM methods and systems
- Material behavior
- Modeling material damage
- Life prediction
- Sensory systems
- Ultrasonic guided waves
- Vibration monitoring
- Signal processing & data fusion
- Diagnostics & prognostics

Sponsored by the
Center of Excellence in
Structural Health Monitoring
www.esm.psu.edu/shm

About the Instructors

Prof. Joseph Rose, Engng Science & Mechanics ... Paul Morrow Professor, researches ultrasonic guided waves and associated technologies including sensors, phased arrays, tomography



Dr. Karl Reichard, Applied Research Laboratory ... complex systems monitoring and automation, prediction of health of mechanical and electrical systems, intelligent autonomous systems



Prof. Martin Trethewey, Mechanical Engng ... condition based machine health monitoring, analysis of machine dynamics from experimental data



Prof. Charles Bakis, Engng Science & Mechanics ... Distinguished Professor, Dir. of Composites Lab, design, manufacture, test, and analysis for lightweight structures and concrete reinforcement



Prof. Cliff Lissenden, Engng Science & Mechanics...director of the Center of Excellence in Structural Health Monitoring, researches guided waves for monitoring composites and material behavior



SHM is the continuous or regular monitoring of the condition of a structure or system using built-in or autonomous sensory systems, and any resultant intervention to preserve structural integrity. The goal of SHM is to improve public safety, reduce maintenance costs, improve readiness, and foster a paradigm shift in design. While SHM is a broad multidisciplinary field both in terms of the diverse science and technology involved as well as its varied applications, there are fundamental concepts associated with a successful SHM system. Toward this end, SHM system developers and users should have a firm grasp of:

- Material behavior, especially its damage and failure modes,
 - Sensory systems appropriate for characterizing material state and its evolution,
 - Basic models for material, component, and system degradation and remaining life,
 - Data driven prognostics for complex systems.
- The SHM short course will introduce students to each of these and then develop in detail a few of the elements.

Course Objectives: Students will be able to...

1. describe and compare various types of diagnostics for SHM applications
2. select a viable SHM methodology for a given application based on available technology
3. apply the mechanics of guided waves for SHM applications to detect structural defects
4. analyze vibration data from a complex system and use it to predict remaining fatigue life

Tuesday, July 8 9:00 am - 8:00 pm

- Welcome & Introduction (Prof Lissenden)
- SHM Overview: history, fields, technologies, and applications (Prof Lissenden)
- SHM Framework: material/component/system behavior, diagnostics, prognostics (Prof Lissenden)
- Lunch
- Material behavior fundamentals (Prof Lissenden)
- Composite materials (Prof Bakis)
- Damage mechanics (Prof Lissenden)
- Mechanical testing lab
- Reception
- Dinner

Wednesday, July 9 8:00 am - 4:00 pm

- Introduction (Prof Rose)
- Ultrasonic guided wave theory (Prof Rose)
- Experiment set I
- Ultrasonic guided wave theory (Prof Rose)
- Lunch
- Experiment set II
- Ultrasonic guided wave SHM applications (Prof Rose)
- Experiment set III

Free time to explore Centre County on your own (hiking, boating, golf, etc) and/or State College Spikes v Hudson Valley Renegades, NYPL minor league baseball, 7:05 pm

Thursday, July 10 9:00 am - 4:30 pm

- Introduction (Prof Reichard/Trethewey)
- Dynamical systems and vibrations (Prof Trethewey)
- Fatigue life prediction (Prof Lissenden)
- Lunch
- Prognostics I - moving from diagnostics to prognostics (Prof Reichard)
- Prognostics II - signal processing and data fusion approaches (Prof Reichard)
- Prognostics III - system examples (Prof Reichard)
- Closure (Prof Lissenden)

Instructors will assume that students have a B.S. degree in one of the engineering disciplines.

Registration Form

- | | |
|---|------------|
| <input type="checkbox"/> SHM Center Member Registration | No charge* |
| <input type="checkbox"/> Full Registration Fee | US \$1495 |
| <input type="checkbox"/> Full-time Student Registration | US \$695 |

*members of the Center of Excellence in Structural Health Monitoring are eligible to send two people to the short course for free.

Course fee includes refreshments, lunches, the reception/dinner, handouts, and certificate.

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| Name: |
| Company: |
| E-mail Address: |
| Mailing Address: |
| City/State/Zip: |
| Phone Number: |
| Method of Payment: check VISA MC . |

Direct questions to Cliff Lissenden (Lissenden@psu.edu) or Karen Powers (krp12@engr.psu.edu)

Fax completed registration form to: (814) 865-9974

Or mail to: 212 EES Bldg, University Park, PA 16802

Call Karen Powers (814) 863-0870 to pay by credit card or make checks payable to: Penn State University

