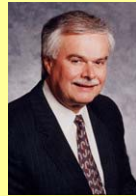




## About the Instructors

### **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. Francesco Costanzo, Engng Science & Mechanics...**, damage and fracture mechanics modeling across length scales, micromechanics



**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

# Structural Health Monitoring

## Short Course

23-25 June 2010

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](http://www.esm.psu.edu/shm)

**Wednesday, June 23 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)
- Mechanical testing lab
- Picnic

**Thursday, June 24 8:00 am - 4:00 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)

Free time to explore Centre County on your own (hiking, boating, golf, etc)

**Friday, June 25 9:00 am - 4:30 pm**

- Introduction (Prof Lissenden/Rose)
- Damage mechanics (Prof Costanzo)
- Ultrasonic guided wave theory (Rose)
- Experiment set I
- Ultrasonic guided wave theory (Rose)
- Lunch
- Experiment set II
- Ultrasonic guided wave SHM applications (Prof Rose)
- Experiment set III
- Closure (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 \$1295  |
| <input type="checkbox"/> Full-time Student Registration | US \$495   |

\*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, picnic, handouts, and certificate.

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](mailto:Lissenden@psu.edu)) or Ed Smith ([ecs5@engr.psu.edu](mailto:ecs5@engr.psu.edu))

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

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

Call Cliff Lissenden (814) 863-5754 to pay by credit card or make checks payable to: Penn State University

