

Prognostics and Health Management
ENME 808A – Fall 2007
Tuesdays 10:00 AM – 12:30 PM (EGR 3111)
Instructor: Professor Michael G. Pecht

Prognostics and health management (PHM) is a method that permits the reliability of a system to be evaluated (health) and predicted (prognostics) in its actual application conditions. Based on PHM, procedures can be developed to mitigate, manage risks and maintain the system. In recent years, prognostics and health management (PHM) has emerged as a key enabling technology to provide an early warning of failure; to forecast maintenance as needed; to reduce maintenance cycles; to assess the potential for life extensions; and to improve future designs and qualification methods. For example, today your car can have integrated sensors, on-board algorithms, telemetry systems, and a global positioning system. The vehicles can be tracked using the unique vehicle identification number and interrogated randomly from a remote location to acquire sensor data and assess the on-going health and time for next maintenance (prognostics).

The application areas include structures, machine-tools, aircrafts, electronics, computers, and humans. Topics covered include methods for in-situ monitoring, approaches for resource efficient data collection, algorithms for data reduction and parameter extraction, software for damage assessment, methods for identifying and analyzing precursors based on failure mechanisms, and techniques for predictions that can be used for assisting maintenance and logistics decisions.

This is an interdisciplinary course and students in many areas including mechanical, electrical, civil, and aerospace engineering, public policy, and engineering management are welcome. Several lectures in this course will be taught by experts from industry, government, and academia. Students will get the opportunity to learn the basic scientific foundations that enable prognostics and health management and work on its implementation for real-life applications through projects.

The knowledge of PHM methodologies and technologies will prepare students to develop and implement PHM to provide an early warning of failure; to forecast maintenance as needed to avoid scheduled maintenance and extend maintenance cycles; to assess the potential for life extensions; to reduce the amount of redundancy, and to improve future designs and qualification methods. On completion of this course, you will have the fundamental knowledge and skills in develop and implement PHM concepts for electrical, mechanical, electro-mechanical, civil, aerospace, and electronic systems. Specifically you will have the knowledge needed to:

- Develop novel methods for in-situ monitoring of products and systems in actual life-cycle conditions
- Plan and implement telemetry and data processing concepts
- Develop algorithms and models for data reduction and parameter extraction
- Assess methods for damage estimation of components and systems due to field loading conditions
- Identify and analyze failure precursors based on failure mechanisms
- Understand statistical techniques used techniques for making predictions
- Understand the logistics and supply-chain challenges in PHM implementation
- Assess the cost and benefits of prognostic implementations

UMD Lecturers:

Professor Michael Pecht Room 1103 ELB Tel: (301) 405-5323 pecht@calce.umd.edu	Professor Peter Sandborn Room 3127 GMH Tel: (301) 405-3167 sandborn@calce.umd.edu	Professor Donald Barker Room 2110 GMH Tel: (301) 405-5264 dbarker@calce.umd.edu
Dr. Michael Azarian Room 0107 GMH Tel: (301) 405-7555 mazarian@calce.umd.edu	Myra Torres Room 1100 ELB Tel: (301) 405-5331 myra@calce.umd.edu	

Office Hours: Thursday and Friday 2:00 – 3:15 PM. You are welcome to drop by our offices anytime. Calling or emailing in advance is suggested. Questions raised due to skipping of class should be avoided.

Expectations of Students:

Attendance: Attending all classes generally leads to good grades. Except in emergency, late assignments will not be accepted for credit.

Communication Style: Ask questions whenever they occur to you. Email communication through the class web page is also encouraged.

Academic Integrity: The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit:

<http://www.shc.umd.edu>

Project:

The course project (in teams) will be the major part of the learning and it will also determine the grade. Each team (2 persons) will come up with a detailed project description based on the suggested topics provided in the class web site. Projects may include development and demonstration of concepts, models, software programs, hardware prototypes (e.g., scaled models, bread-board circuits) for implementing prognostics and health management of real life applications. You will be graded on your contribution to the state-of-the-art as shown in your written report, classroom presentations, and demonstrations of software or sensor-system prototypes.

Project Schedule and Grading:

Week of	Deliverable	Percentage of grade
Sep 11, 2007	Consultation with instructor and/or course assistant. Formation of project groups.	NA
Oct 1, 2007	Project proposal. Provide a two page document on concept, approach, and work plan (1-2 pages with initial references)	5
Oct 15, 2007	Commented proposal returned	N/A
Oct 29, 2007	Project status report #1: Achievement of a minimum of 30 % of project goals is expected.	10
Nov 5, 2007	Commented status reports returned	N/A
Nov 19, 2007	Project status report #2. Achievement of a minimum of 75% % of project goals is expected.	10
Nov 26, 2007	Commented status report returned	N/A
Dec 10, 2007	Project presentation	30
Dec 10, 2007	Final report	45

- Project reports need to be written in Word format. A template will be provided for format consistency.
- All work needs to be referenced in a formal manner.
- All reports need to be submitted in both hardcopy and in searchable electronic format.

Web site: <https://bb.eng.umd.edu/>

All registered students will be given access to the course web site. Visit the site for instructions on instructions on how to obtain login/password.

Papers and research documents: Will be handed out in class and will be considered required reading.