

CoE SHM is a *multidisciplinary team* of *Penn State faculty* from throughout the College of Engineering (Engineering Science and Mechanics, Aerospace Engineering, Civil Engineering, Mechanical Engineering, Electrical Engineering) and the Applied Research Laboratory.

The CoE SHM was formed in January of 2007 with funding from the Ben Franklin Technology Partners. The funding from Ben Franklin is matched at least 1:1 by other Center income and will last up to three years.

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www.esm.psu.edu/shm



Civil Infrastructure



Aerospace



Mechanical Equipment



SHM is...

- *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
- *a broad multidisciplinary field both in terms of the diverse science and technology involved as well as its varied applications
- *implemented on diverse systems and structures such as aircraft, spacecraft, ships, helicopters, automobiles, bridges, buildings, civil infrastructure, power generating plants, pipelines, electrical systems, manufacturing and processing facilities, biological systems, and for the protection of the environment, and for defense

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Ben Franklin
Technology Partners
Central and Northern Pennsylvania



Center of Excellence In Structural Health Monitoring

Mission: Advance the state-of-the-art in structural health monitoring (SHM) to improve public safety, reduce maintenance costs, improve readiness, and foster a paradigm shift in design by leveraging and fostering collaborative R&D efforts between academia, industry, and government entities. Provide a means for transferring technology to member companies, agencies, and institutions.

Objectives:

- *Spur the research and development of new SHM technologies
- *Transfer SHM technologies to member companies to give them a competitive advantage
- *Make PA a hotspot for structural health monitoring, creating a new high tech job market that will provide jobs for residents and draw people and SHM industries to PA
- *Train students to provide an outstanding workforce pool in SHM technology areas

Vision: Bring designers and owners of platforms that benefit from SHM technology together with researchers and developers of SHM systems. Grow the Center by building relationships that lead to fruitful multidisciplinary collaborations between industry, academia, and government.

CoE SHM

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New in Vibration Monitoring

Dr. Reichard's Complex Systems Monitoring and Automation Department at ARL in conjunction with the Penn State College of Engineering has developed and implemented a low cost solution for health monitoring of rotating shafts. This on-line, non-invasive technique can be embedded on a small processing platform and uses a wide-variety of non-contacting sensors (Hall-effect, Laser, optical, etc.). The technique provides immunity to lateral vibration background noise and provides sensitivity to track small changes in shaft torsional frequencies. It has been shown that this technology has detected cracks in shafts while other classical approaches failed. This system has been installed on pumps at a Tennessee Valley Authority facility and has operated for the last few years. This work was sponsored by the Electric Power Research Institute. Lead developers are Mitchell Lebold and Martin Trethewey.

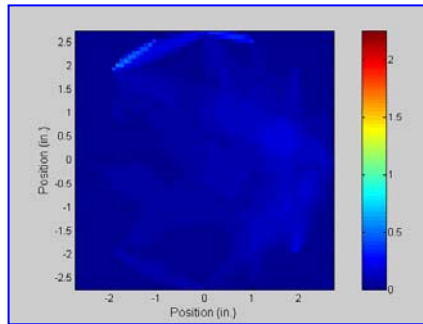


Image before corrosion

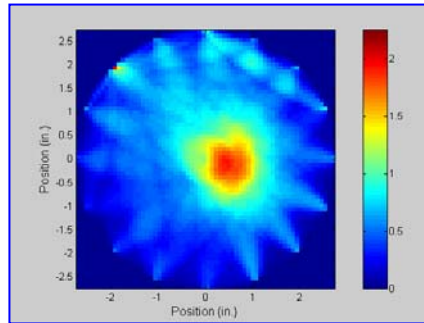
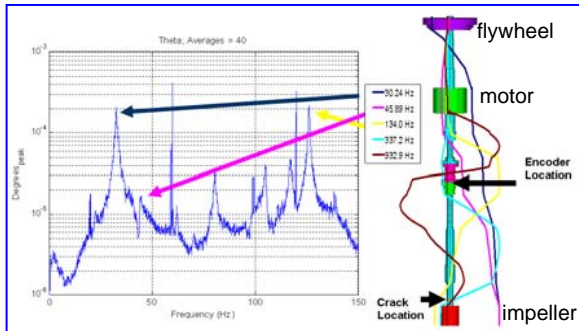


Image showing localized material loss due to corrosion



New in Ultrasonics

Prof. Rose's group invented and developed ultrasonic guided wave tomographic imaging methods for visualizing damage in a structure with an array of embedded active sensors. Damage could be due to corrosion, cracking, delamination of a composite, failed fasteners, etc. New computational algorithms and physically based (wave mechanics) features improve image development. Sensor features that provide better mode and frequency control improve the sensitivity and penetration power of guided waves for monitoring aircraft, composite materials, pipes, and more.

Benefits of CoE SHM membership:

- *Develop relationships and partner with participating faculty and members
- *Non-exclusive royalty free rights to use Center generated IP
- *Gain access to students with experience in SHM technologies
- *Gain access to faculty
- *Faculty assistance through various means to suit member needs: laboratory feasibility studies, 1-day site visit, mini workshop, telephone, etc.
- *Summer short courses for members
- *Keep up with the latest developments and technologies in the fast growing multidisciplinary field through membership meetings, newsletters, and website
- *Guide investigators to solve problems important to your products through the advisory board and informally
- *Develop member-specific projects having separate contracts and IP agreements based on the needs of the member
- *Visibility

08/31/07