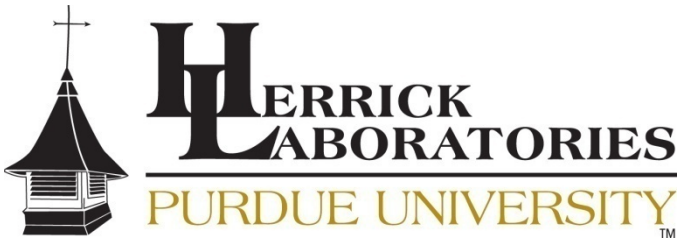
PROGNOSTICS AND DIAGNOSTICS RESEARCH



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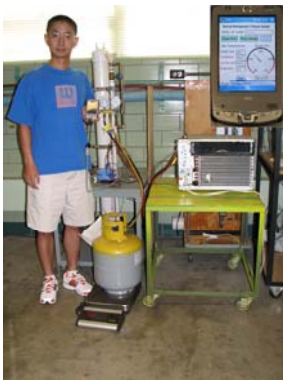
Diagnostics & Prognostics for Engineered Systems

Radically new requirements in safety and performance for mechanical and electrical products are transforming the way we engineer them. For example, manufacturers of gas turbine engines for airplanes now sell 'time on wing' to airlines instead of engines. In this new 'pay as you go' business environment, manufacturers pay the costs for servicing and fixing engines instead of the airlines. If engine health is poorly managed, the manufacturer's profits can plummet. A somewhat similar scenario is unfolding for buildings. Companies are now offering complete facility management and maintenance leading to reduced cost-to-benefit ratios for implementing diagnostics. Automotive manufacturers of cars and trucks are also leasing vehicles rather than selling them. These manufacturers are searching for new ways to effectively manage vehicle health in order to reduce warranty costs and increase aftermarket profits.

Federal agencies are also implementing sweeping changes in product requirements. For example, emissions standards for engines, durability standards for tires, readiness requirements for weapon systems, security requirements for terrestrial power and transportation systems, energy standards for buildings and associated equipment, and reliability requirements for exploratory space systems are all being addressed by government officials.

These trends in consumer, commercial, and defense applications make it critically important for manufacturers to embed technologies insides of their products to help manage them. Diagnostic devices are embedded into products to identify how they are used, develop faults, and fail. Prognostic methods are then used to predict and manage the health of these products. Sensors and embedded processors and algorithms for monitoring products are the building blocks of diagnostics & prognostics.



The advantages of diagnosis & prognosis in a wide range of mechanical, electrical and other products have been demonstrated by researchers at the Herrick Labs in consumer, commercial, and defense applications.

Dr. Doug Adams
Dr. James Braun

DIAGNOSTICS/PROGNOSTICS THESES

NAME	YEAR	DEGREE	PROFESSOR(S)	TITLE
Abram, Kwin R. HL 94-11	1994	MSME	Bernhard, R.J.	Indirect Measurement of Internal Engine Forces
Ackers, Spencer HL 2007-4	2007	MSME	Adams, D.E.	A Method for Crack Detection in a Wheel End Spindle Using Broadband Modal Excitation
Adams, John A. HL 71-15	1971	Ph.D.	Hamilton, J.F./ Soedel, W.	The Prediction of Dynamic Strain in Ring Type Compressor Valves
Bahr, Ronald A. HL 70-47	1970	MSME	Soedel, W.	Residual Stresses in a Pressure-Displacement Converter Diaphragm Due to Boundary Contraction and Localized Plastic Deformation
Bell, Ian HL 2011-4	2011	Ph.D.	Braun, J.E./Groll, E.	Theoretical and Experimental Analysis of Liquid Flooded Compression in Scroll Compressors
Bendapudi, Satyam	2004	Ph.D.	Braun, J.E.	Development and Evaluation of Modeling Approaches for Transients in Centrifugal Chillers
Berther, Thomas HL 90-6	1990	MSME	Davies, P.	Condition Monitoring of Check Valves in Reciprocating Pumps
Brackney, Larry J.	1994	Ph.D.	Shoureshi, R.	Automated Reasoning Techniques for Intelligent Control of Building Systems
Breuker, Mark HL97-29	1997	MSME	Braun, J.E.	Evaluation of a Statistical, Rule-Based Fault Detection and Diagnostics Method For Vapor Compression Air Conditioners
Brush, Ethan	2009	MSME	Adams, D.E.	Development of a Dynamic Model for Subsurface Damage in Sandwich Composites
Budde, Carson	2010	MSME	Adams, D.E.	Impact Force Identification for Composite Helicopter Blades Using Minimal Sensing
Buehler, Patarick J.	2002	MSME	Franchek, M.A.	Fault Detection, Isolation and Identification Via Information Synthesis
Butner, Charles M.	2011	MSME	Adams, D.E.	Investigation of the Effects of Bolt Preload on the Dynamic Response of a Bolted Interface
Chen, Bin HL 2000-16	2000	MSME	Braun, J.E.	Evaluating the Potential of On-Line Fault Detection and Diagnostics for Rooftop Air Conditioner
Chen, Xi	2007	MSME	Chen, Y.	A Numerical Study on Decontaminating Unoccupied Airliner Cabins
Choules, Brian D.	1998	Ph.D.	Kokini, K	Thermal Fracture of Ceramic Coatings Under High Heat Flux with Time-Dependent Behavior

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Comstock, Matthew	1999	MSME	Braun, J.E.	Development of Analysis Tools for the Evaluation of Fault Detection and Diagnostics in Chillers
Cummins, Josh	2010	MSME	Adams, D.E.	Center of Gravity Effects Using Forced Vibration Response Operational Data
Davis, Coby L.	1995	MSME	Braun, J.E.	Non-thesis. Evaluation of Steady-State Detectors for Fault Detection and Diagnostics
Deignan, Paul B. HL99-9	1999	MSME	Meckl, P.	Virtual Sensing: The Development of a Methodology for Internal Combustion Engine Torque Estimation
DiPetta, Tiffany	2011	MSME	Adams, D.E.	Development and Verification of a Diagnostic Cleat for Detecting Faults in Military Wheeled Vehicles
Eberhardt, Frank HL 2011-1	2011	MSME	Davies, P./Bolton, J.S.	Study of the Feasibility of Estimating Combustion Noise Radiation in Reverberant Environments
Faulkner, Lynn L. HL 66-33	1966	MSME	Hamilton, J.F.	Stress Concentration in Refrigeration Compressor Crankshafts
Gayaka, Shreekant	2010	Ph.D.	Yao, B.	An Adaptive Robust Approach to Actuator Fault-Tolerant Control in Presence of Uncertainties and Input Constraints
Geveci, Mert HL 2005-8	2005	Ph.D.	Bernhard, R.J.	Robust Cylinder Health Monitoring for Internal Combustion Engines
Gluck, Rafael HL 63-8	1963	Ph.D.	Cohen, R.	Fatigue Life Index Criteria for Compressor Leaf Valve Design (Development of Fatigue Life Index as a Criterion for Evaluating Compressor Leaf Design)
Gupta, Jitendra	2010	Ph.D.	Chen, Y.	Respiratory Exhalation/Inhalation Models and Prediction of Airborne Infection Risk in an Aircraft Cabin
Hao, Jiang	2008	Ph.D.	Adams, D.E.	Material Damage Modeling and Detection in a Thin Metallic Sheet and Sandwich Panel Using Passive Acoustic Transmission
Haroon, Muhammad	2003	MSME	Adams, D.E.	Nonlinear System Identification of a Tire-Vehicle Suspension System Using Response Transmissibility
Haroon, Muhammad HL 2007-12	2007	Ph.D.	Adams, D.E.	A Methodology for Mechanical Diagnostics and Prognostics to Assess Durability of Ground Vehicle Suspension Systems
Houtteman, Matthew	2011	MSME	Adams, D.E.	Applications of Eigenmode Coupling to

NAME	YEAR	DEGREE	PROFESSOR(S)	TITLE
				Damage Detection in Beams
Hundhausen, R. Jason HL 2004-8	2004	MSME	Adams, D.E.	Mechanical Loads Identification and Diagnosis for a Standoff Metallic Thermal Protection System Panel in a Semi-Realistic Thermo-Acoustic Operating Environment
Jankov, Dusan HL 85-17	1985	MSME	Soedel, W.	Valve Failure Detection in Refrigeration Compressors
Jaques, Janette HL 2006-13	2006	MSME	Adams, D.E.	Headrest Rattle: Nonlinear Model Identfication and Analysis
Jaques-Meyer, Janette	2011	Ph.D.	Adams, D.E.	Using Impact ddddddddddmodulation to identify Loose Bolts in a Satellite Structure
James, Scott HL 2007-11	2007	MSME	Meckl, P.	Diesel Engine Diagnostics Using Singular Spectrum Analysis
Jiang, Hao	2008	Ph.D.	Adams, D.E.	Material Damage Modeling and Detection in a Thin Metallic Sheet and Sandwich Panel Using Passive Acoustic Transmission
Johnson, Timothy J. HL 2006-21P	2006	Ph.D.	Adams, D.E.	Diagnostics of Bead Area Damage in Rolling Tire Durability Tests
Joshi, Alok A. HL 2007-13	2007	Ph.D.	Meckl, P./King, G./Jennings, K.	Strategies for Data-Based Diesel Engine Fault Diagnostics
Kakade, Ravindra Hl 2011-3	2011	MSME	Meckl, P.	Fault Detection Using Spectral Methods: Wavelets and Correlation Techniques
Kess, Harold	2005	MSME	Adams, D.E.	Investigation of Operational and Environmental Variability Effects on Damage Detection Algorithms in Heterogeneous (Woven Composite) Plates
Kim, Jong Shik HL 86-4	1986	Ph.D.	Soedel, W.	Three Dimensional Transient Stress Wave Propagation in a Plate with Application to Compressor Valve Failure Analysis
Kim, Woohyun HL 2009-12	2009	MSME	Braun, J.E.	Evaluation of a Virtual Refrigerant Charge Sensor
Kim, Yoon-Ki	2000	Ph.D.	Soedel, W.	Forced Response of Tires with Mass Nonuniformities Using Ring Models
Kincaid, Nicholas	2012	MSME	Groll, E.	Non-thesis: Humidity Ratio Detection as a Means of Dryer Cycle Termination
Kostek, Theodore M. HL 2005-3P	2005	Ph.D.	Franchek, M.	Aging of Zeolite Based Automotive Hydrocarbon Traps with Applications to Diagnostics

NAME	YEAR	DEGREE	PROFESSOR(S)	TITLE
Kusmanto, Robin HL 2009-3	2009	MSME	Adams, D.E.	Modeling and Simulation of an Optimized Wireless Network in a Naval Ship System of Systems
Lee, Hsu Chew	2012	MSME	Li, K.M.	A Study of Low Speed Flow Noise and Its Reduction by Numerical Simulations
Li, Haorong	2004	Ph.D.	Braun, J.E.	A Decoupling-Based Unified Fault Detection and Diagnosis Approach for Packaged Air Conditioners
Liu, Yangfan	2011	MSME	Bolton, J.S./Davies, P.	Sound Field Reconstruction and its Application in Loudspeaker Sound Radiation Prediction
Marshall, Andrew HL 2012-2	2012	Ph.D.	Davies, P.	Development of a Model of Startle Resulting from Exposure to Sonic Booms
Martin, Brett G. HL 2003-4	2003	MSME	Meckl, P.	The Use of Information Theory in Input Space Selection for Modeling and Diagnostic Applications
McGuire, Sarah HL 2012-4	2012	Ph.D.	Davies, P.	Modeling Aircraft Noise Induced Sleep Disturbance
McKellar, Michael G. HL 87-44	1987	MSME	Tree, D.R.	Failure Diagnosis for a Household Refrigerator
McKay, Shawn	2009	Ph.D.	Adams, D.E.	A Control Theory Based Hybrid Architecture to Anticipate and Shape Adversarial Behavior
Meyer, Alan	2011	MSME	Adams, D.E.	Damage Identification for Healtthy Monitoring of Ground Vehicle Through Active Probing of Vehicle Response
Moaveni, Michael HL 72-1	1972	Ph.D.	Hamilton, J.F./ Cohen, R.	The Prediction of Dynamic Strain in Leaf-Type Compressor Valves with Variable Mass and Stiffness
More, Ranjit HL 2011-6P	2011	MSME	Meckl, P.	Diagnostics of Advanced Diesel Fuel Injectors
More, Shashikant HL 2010-7	2010	Ph.D.	Davies, P.	Aircraft Noise Characteristics and Metrics
Oh, Hilario L. HL 63-22	1963	MSME	Cohen, R.	Dynamic Strains on a High Speed Compressor Discharge Valve
Padmanabhan, Hemanth	2001	MSME	Franchek, M.	Non-thesis. Engine Diagnostics
Pidaparti, Ramana M.V. HL 98-22	1989	Ph.D.	Yang, H.T./ Soedel, W.	Modeling and Fracture Prediction in Rubber Composites
Pranati, Surve HL 2008-5	2008	MSECE	Meckl, P.	Diesel Particulate Filter Diagnostics Using Correlation and Spectral Analysis

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Prewett, Emily	2008	MSME	Adams, D.E.	Modeling and Identification of Damage in Composite Materials
Ro, Hee Seung HL 89-36	1989	Ph.D.	Soedel, W.	Modeling and Interpretation of Fatigue Failure Initiation in Rubber Related to Pneumatic Tires
Robbins, Tyler	2011	MSME	Adams, D.E.	Development and Verification of Data Analysis Strategies for Characterizing Military Helmet-Head Performance
Robinson, Daniel H.	2007	MSME	Bernhard, R.J.	Effect of Low Frequency Sound on Resonant Sound Insulation and Rattle Systems
Roecker, Ryan	2001	MSME	Franchek, M.	Non-thesis. Engine Diagnostics
Rossi, Todd M. HL 95-13	1995	Ph.D.	Braun, J.E.	Detection, Diagnosis, and Evaluation of Faults in Vapor Compression Cycle Equipment
Sasidharan, Premjee HL 2008-1	2008	MSME	Meckl, P.	Development of an Electronic Fuel Injection System for a Small Electric Power Unit
Schultz, Ryan E. HL 2010-10P	2010	MSME	Meckl, P.	Light-Off Temperature Shift as a Detection Method of Catalyzed Diesel Particulate Filter Nonmethane Hydrocarbon Oxidation Efficiency Degradation
Shah, Chintan HL 2008-9	2008	MSME	Meckl, P.	Particulate Matter Load Estimation in Diesel Particulate Filters
Silverstein, Brian R.	1995	Ph.D.	Davies, P.	Monitoring of Valve Condition in Reciprocating Pumps by Analysis of Vibration Signatures
Smith, Clarence C. HL 88-27	1988	MSME	Kokini, K.	Transient Thermal Fracture of Bonded Dissimilar Materials
Stallard, Laura HL 89-25	1989	MSME	Shoureshi, R.	Model Based Expert Systems for Failure Detection and Identification of Household Refrigerators
Stites, Nick HL 2007-3	2007	MSME	Adams, D.E.	Minimal-Sensing, Passive and Semi-Active Load and Damage Identification Techniques for Structural Components
Sundararaman, Shankar HL 2003-8	2003	MSME	Adams, D.E.	Structural Diagnostics Through Beamforming of Phased Arrays: Characterizing Damage in Steel and Composite Plates
Sundararaman, Shankar HL 2007-6	2007	Ph.D.	Adams, D.E.	Numerical and Experimental Investigations of Practical Issues in the Use of Wave Propagation for Damage Identification
Surve, Pranati HL 2008-5	2008	MSECE	Meckl, P.	Diesel Particulate Filter Diagnostics Using Correlation and Spectral Analysis
Wagner, John R.	1989	Ph.D.	Shoureshi, R.	Nonlinear Observer Design and Failure

NAME	YEAR	DEGREE	PROFESSOR(S)	TITLE
HL 89-11				Diagnostics for Thermofluid Systems
Wang, Bryan	2012	MSME	Adams, D.E.	Kinematic Center of Gravity Estimation Method of Ground Vehicle Based on Dynamic Measurements
Wang, Miao	2011	Ph.D.	Chen, Y.	Modeling Airflow and Contaminant Transport in Enclosed Environments with Advanced Models
White, Jonathan HL 2006-7P	2006	MSME	Adams, D.E.	Impact and Thermal Damage Identification in Metallic Honeycomb Thermal Protection System Panels Using Active Distributed Sensing with the Method of Virtual Forces
White, Jonathan	2010	Ph.D.	Adams, D.E.	Operational Monitoring of Horizontal Axis Wind Turbines with Inertial Measurements
Wichman, Adam HL 2007-8	2007	MSME	Braun, J.E.	Evaluation of Fault Detection and Diagnosis Methods for Refrigeration Equipment and Air-Side Economizers
Wulf, Tanya HL 2009-9	2009	MSME	Bernhard, R.J.	A Study of the Effect of innovatively Textured Portland Cement Concrete Roadway Surfaces on Tire-Pavement Noise
Xue, Guangqing	2011	MSME	Chen, Y.	Design Tool for Under-Floor Air Distribution System
Yang, Chulho HL 2004-11	2004	Ph.D.	Adams, D.E.	Experimental Embedded Sensitivity Functions for Use in Mechanical System Identification
Yoder, Nathanael	2010	Ph.D.	Adams, D.E.	The Robust Detection of Cracks in Complex Aerospace Structures Using Nonlinear Vibro-Acoustic Modulation
Zhang, Tengfei	2007	Ph.D.	Chen, Y.	Detection and Mitigation of Contaminant Transport in Commerical Aircraft Cabins
Zhang, Zhao	2007	Ph.D.	Chen, Y.	Modeling of Airflow and Contaminant Transport in Enclosed Environments
Zhong, Zhipeng HL 2008-3	2008	Ph.D.	Braun, J.E.	Combined Heat and Moisture Transport Modeling for Residential Buildings
Zuo, Wangda	2010	Ph.D.	Chen, Y.	Advanced Simulations of Air Distributions in Buildings
Zwink, Brandon	2010	MSME	Adams, D.E.	Nondestructive Evaluation of Composite Material Damage Using Vibration Reciprocity Measurement

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Purdue University Libraries: http://www.lib.purdue.edu/access/ill/td