

Engineering Institute



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The Engineering Institute

The Engineering Institute (EI) is a collaboration between LANL and the University of California at San Diego (UCSD) Jacobs School of Engineering whose mission is to develop a comprehensive approach for 1) conducting mission-driven, multidisciplinary engineering research and 2) recruiting, revitalization and retention of the current and future staff necessary to support LANL's stockpile stewardship responsibilities.

The components of the Engineering Institute are 1) the Los Alamos Dynamic Summer School 2) a joint LANL/UCSD degree program with a unique focus in validated simulations, structural health monitoring, and damage prognosis, 3) joint LANL/UCSD research projects, and 4) industry short courses.

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Course Solicitation for UCSD Distance Learning

Listed are course sequences offered by the University of California's Jacobs School of Engineering that LANL's Engineering Institute is considering offering during the 2008-2009 academic year. We are soliciting your input for classes that will be transmitted to Los Alamos through a two-way distance learning system that is located in the Los Alamos Research Park. If you are interested in having any of these classes or a class sequences offered at LANL please send an e-mail to Kathie Womack (Womack@lanl.gov) by August 1st.

Signal Processing

Introduction to Digital Signal Processing
Digital Signal Processing
Array Processing
Detection Theory
Parameter Estimation
Stochastic Processes in Dynamic Systems
Sensor Networks
Random Processes

Embedded Systems

Introduction to Embedded Systems
Software for Embedded Systems
Validation and Testing of Embedded Systems
Design Automation and Prototyping for Embedded Systems

Parallel Computing

Large Scale Computing
System Support for Parallel Computation

Controls

Linear Systems Theory
Nonlinear Control Systems
Approx Identification and Control
Applied Structural Control

NDE/SHM

Experimental Mechanics and NDE
Structural Health Monitoring

Structural Dynamics

Structural Dynamics
Advanced Structural Dynamics
Nonlinear Mechanical Vibration
Random Vibrations
Wave Propagation in Elastic Media
Wave Propagation in Continuous Structural Elements

Applied Mechanics

Theory of Elasticity SE 272
Theory of Plasticity & Viscoelasticity
Structural Stability
Solid Mechanics for Structural and Aerospace Engineering
Mechanics of Laminated Composite Structures

Computational Mechanics

Numerical Methods
Finite Element Analysis I & II
Computational Fluid Dynamics
Verification and Validation

Mode in which you would like to take the class.

- You can sign up for a class under concurrent enrollment where you are not part of a degree program. This mode of enrollment is appropriate for staff wanting to take course in fulfillment of continuing education requirements needed to maintain professional engineering registration. Should you decide to pursue and be accepted into a UCSD Jacobs Scholl graduate degree program, up to 24 units of credit may be applied for course taken concurrently.
- If you are interested in pursuing a graduate degree (MS or Ph.D.), you can enroll in a program and perform most of the degree requirements here at LANL. For those interested in this option, Kathie Womack will arrange a meeting with the EI staff to discuss this program in more detail.

Also note that this is not a complete listing of engineering courses or a complete requirement to get a degree. The EI staff will work with you to get classes from the Jacobs school of Engineering offered if there is sufficient interest. A complete requirement and list can be found at the respective engineering departments' web pages. Here is a link to the department in the school: <http://www.jacobsschool.ucsd.edu/academic/departments.shtml>



LADSS Lecture Series

Tutorials

- July 7-10th** - Computational Structural Dynamics, Miles Buechler (LANL)
- July 14-17th** - Model Validation, Francois Hemez (LANL)
- July 21-25th** - Nonlinear Dynamics, Doug Adams (Purdue University)
- July 28-31st** - Wave Propagation, Anthony Puckett (LANL)

Guest Lectures

- July 1st** - High Explosives Radio Telemetry System, Tom Petersen (LANL)
- July 3rd** - Predictive Process Dynamics, Matt Bement (LANL)
- July 15th** - Sports Equipment Dynamics, John Kosmatka (UC-San Diego)
- July 17th** - Machine Learning and it Applications to Structural Dynamics, Keith Worden (U. of Sheffield, UK)
- July 22nd** - Smart Structures, Don Leo (Virginia Tech)
- July 24th** - Fiber Optic Sensing, Mike Todd (UC-San Diego)
- July 29,30th** - Alexis and Forte Satellite, Tom Butler (LANL)

These lectures are open to all LANL staff and students. Staff members can use the guest lectures to meet the continuing education credit requirements needed to maintain a professional engineer's license. We will issue certificates of attendance to staff for the purpose of documenting their attendance in order to verify that they have met the PE continuing education requirements. For more information, visit the EI's website (<http://www.lanl.gov/projects/ei>) or contact Kathie Womack, 663-5206.

SOUND&VIBRATION

DYNAMIC TESTING

APRIL 2008

Wireless structural monitoring
Photo modeling for FEA



Sound and Vibration Magazine featured one of the Engineering Institute's collaborative research projects with the University of California, San Diego (UCSD) in its April 2008 issue. This project has developed novel approaches to remotely powering embedded sensing systems with robotic devices (in this case a remote controlled helicopter as shown on the cover of the April 2008 issue) that bring a radio frequency energy source to the vicinity of the sensor nodes, transmit the energy in a wireless manner to a receiving antenna connected to the node that, in turn, provides the power for the sensor to take its reading and broadcast the reading back to a microprocessor on the robotic vehicle.

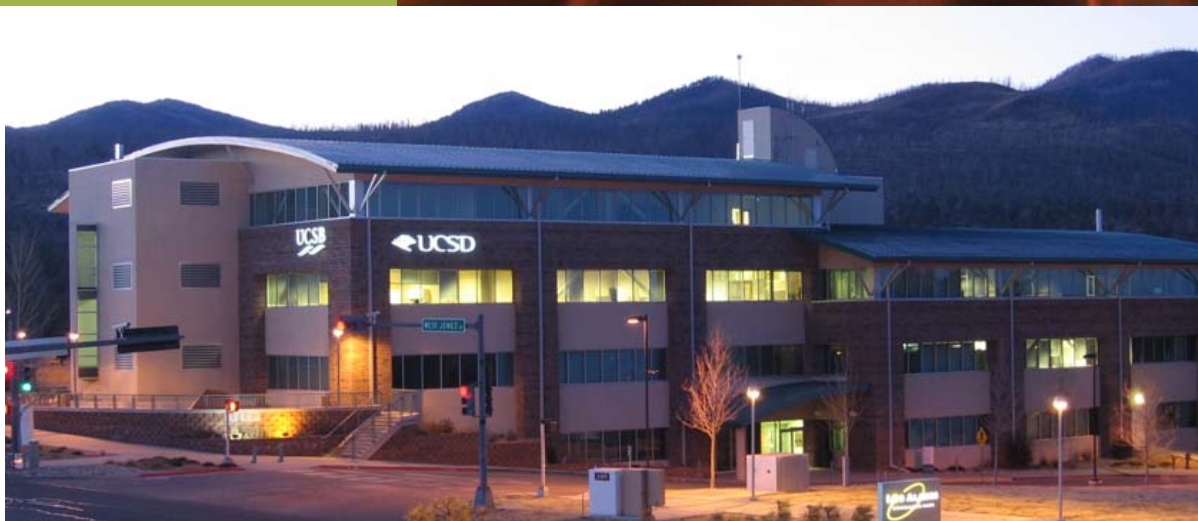
This sensor node power strategy alleviates the need for batteries to be embedded with the node. The system was successfully demonstrated on a bridge structure in southern New Mexico this past August where peak strain readings and bolted-connection preload values were obtained remotely by the helicopter. Although demonstrated on a bridge structure, this approach to remotely powering sensor nodes and retrieving data with a robotic device can be used with a wide range of sensing applications. This approach is particularly well suited for applications that require long-term field deployment of the sensor nodes and deployment in hazardous environments.

Engineering Institute's research featured on magazine

Wireless Energy Transmission using a mobile host for powering embedded sensor nodes

The cover photo shows the UCSD graduate student David Mascarenas working with the pilot to prepare the helicopter and its remote power source payload for one of the test flights. This work forms the majority of David's Ph.D. research. Throughout his research David and his Advisor Prof. Michael Todd have worked collaboratively with Gyuhae Park (INST-OFF), Kevin Farinholt (INST-OFF), Roger Bracht (WT-4) and John Sandoval in (WT-7) in the development of this sensing system that will help LANL achieve its goal of being a leader in ubiquitous sensing technology.





Highlights

The Engineering Institute leader, Chuck Farrar delivered a keynote speech at the SPIE smart structures/structural health monitoring conference on March 2008, entitled "Implementing Smart Structures Technology in High-Consequence applications."

Colin Olson, a UCSD student sponsored by EI's joint project completed his Ph.D. degree in March, 2008 in the area of "input shaping and optimization for active probing in structural health monitoring. He has taken on a post-doc position at the US Naval Research Laboratory in Washington, DC.

EI researchers recently received two research grants from Office of Naval Research on Ship-hull Monitoring. The work will be performed with Don Hush (CCS-3), Mike Todd (UCSD) and Francesco Lanza di Scalea (UCSD).

EI-LANL researchers have published more than 12 journal articles and 13 conference proceedings in the first half of 2008.

Advisory Board for Engineering Institute

The EI has formed an internal advisory board to help guide its educational and research activities. The purpose of this Board is to maximize the positive impact the EI's recruiting, training and retention activities have on LANL engineers and maximize the number of line organizations impacted by these activities. The roles and responsibilities of the EI Advisory Board include

- Represent their respective line organization's needs in terms of recruiting, training and retention to the EI staff.

- Guide the collaborative research projects and educational activities of the EI
- Help to define other EI activities such as workshops and development of proposal writing teams
- Bridge a gap between line organization and EI for summer internships, for post-doctoral research appointments, or for staff hiring.

The following members will serve on this advisory board for a two-year period, Frank Addressio (T-3, computational continuum mechanics), Don Hush (CCS-3, machine learning), Doug

Kautz (WCM-2, machining process modeling), Thomas Mason (W-6, engineering mechanics), Evelyn Mullen (IAT-DO, nuclear reactor analysis), R. Alan Patterson (MST-DO, materials and manufacturing), Ray Guffee (AET-1, mechanical design), Daniel Rees (AOT-RFE, RF engineering), Angela Mielke (ISR-3, distributed sensor networks).

The EI advisory board will Host a town hall meetings to define Engineering Research for LANL in early August.

2008 Los Alamos Dynamic Summer School

A 9-week program of Los Alamos Dynamic Summer school (LADSS) has started on June 9th. The purpose of this summer school is to focus a select group of prospective upper level undergraduate students and first year graduate students (limited to US citizens) on the broad field of engineering dynamics. Engineering dynamics encompasses technologies such as flight dynamics, vibration isolation for precision manufacturing, earthquake engineering, blast loading, signal processing, and experimental modal analysis.

This year there are 18 students participating in the summer school, each involved in one of the following research efforts,

- Multi-Transducer System for Energy Harvesting
- Initial Mechanical Stability of Cementless Highly-porous Titanium Tibial Components
- Use of a Collocated Sensor/ Actuator for Dynamic Control and SHM
- Dynamic Characterization of Carbon Foils for Space Flight Applications
- Wireless Sensing and Power Harvesting of a Smart Wind Turbine Rotor
- Improving a Turn Process using Piezoelectric Actuators and Ultrasonic-assisted Machining.



EI Annual Workshops

EI hosts an annual workshop with focus on the broad area of engineering discipline. The reports which are the outcome of these workshops are available in our website. We also work with other LANL organizations to co-host workshops. For more information, please contact us.

Upcoming Events

The EI hosts two workshops. Please contact Chuck Farrar (farrar@lanl.gov, 663-5335) for more information.

- UAV workshop (Jointly with IAT-2) on July 14, 2008 —The intent of this internal workshop is to identify LANL's niche in UAV technology applications, and subsequently develop funding/proposal strategy.
- Multifunctional materials for sensing and actuation (jointly with Material Design Institute), August 19-21, 2008.
- Field demonstration of the UCSD-EI joint project, “Coupling UAVs and RF sensing for rapid damage assessment of structures,” is planned at the Alamos Canyon Bridge on Sep. 2-5, 2008.

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