

PURDUE
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Department News



A group of Engineering
Advisory Board Members



Prof. Abramowitz with a
student in the Elementary
Engineering Design course



Prof. Gray shows an ECE Lab
to Engineering Freshman
Seminar Students

From the Department Head...

Dear Friends:

Welcome to the current Engineering newsletter. Our Engineering programs are in the exciting growth stage. We just started 4 new undergraduate degrees: BSCE, BSCmpE, BSEE, and BSME, that will provide great opportunities for our students, faculty, university, and community. We have made more efforts to emphasize experiential learning. More students are participating in internships and industrial projects. Our students are well prepared for entering the work force and well-liked in the job markets. Our faculty members are dedicated to teaching and active in research.

We have a few new additions in the engineering departments. I welcome Dr. Constantin Apostoia, Visiting Instructor in the ECE department; Dr. Yeow Siow, Visiting Assistant Professor in the ME department; and Ms. Janice Novosel, the ECE secretary. The previous ECE secretary Jean Rose has relocated to Wisconsin with her family. I thank Jean for her great contributions to our Engineering programs and wish her the best in Wisconsin.

We are constantly looking for news, suggestions, and comments. Your input are significant for us in creating a learning community that brings together our faculty, staff, students, alumni, friends, and industry partners to provide the best possible education for our students.

Chenn Q. Zhou, Head of ME Dept. and Interim Head of ECE Dept.

Senior Design News

Professor Howard Gerber, the professor in charge of ECE/ME 429 Senior Design I, reports that this fall semester started off with a record number of projects associated with industry. Out of 15 total projects, 12 (80%) are from industry. Most of the projects came from Mittal Steel, as listed below:

- ◆ Computation Fluid Dynamics (CFD) simulation of a reheat furnace
- ◆ Design of a Web-based 3D tutorial for visualization of a ternary phase diagram
- ◆ Design of a closed loop control for a hot blast stove
- ◆ Experimental determination of slag viscosity from a Basic Oxygen Furnace
- ◆ Measurement of water spray heat transfer coefficient for a billet caster
- ◆ Image processing of visual data from a furnace overflow
- ◆ Simulation of an induction strip heating coil for a galvanizing line

Other industrial projects are:

- ◆ Design of a 3D visualization of a Blast Furnace (Mittal and US Steel)
- ◆ Design of a microarchitecture for a RISC processor (Intel Corporation)
- ◆ Design of a fuel cell test system (NuVant Corporation)
- ◆ Analysis of thermal stresses in a triple-walled manifold (Hadady Corporation)
- ◆ Design of a thermoelectric refrigeration system using nanoparticles (ASHRAE)

Senior Design I is the first of a two-semester sequence. Students will continue their projects in ECE/ME 439, Senior Design II, in the following semester. We are constantly looking for projects that match the expertise of our faculty and of industrial advisors. Industrial representatives are encouraged to contact Prof. Howard Gerber at gerber@calumet.purdue.edu, or Prof. Ed Pierson at pierson@calumet.purdue.edu concerning potential projects. The next project selection process starts in early November.

Best Undergraduate Engineering Program Status.

Students Enjoy National and International Competitions

Our engineering students have been active in national and international competitions such as **Great Moonbuggy Race** (below left), **Quarter-Scale Tractor Design Competition** (below center), and **Mini-Baja** (below right). The 13th annual Great Moonbuggy Race, organized by NASA with support from Northrop Grumman, was held April 7th and 8th at the US Space & Rocket Center in Huntsville, Alabama. For the 4th consecutive year, a team of students from the Department of Mechanical Engineering entered this competition. The "Moonbuggy" is a human-powered vehicle which must be driven by one male and one female student. The unassembled vehicle must fit into a 4' x 4' x 4' volume. The two students have to carry the "Moonbuggy" 20 feet to the starting line, and then are timed for assembling the unit. The vehicle then undergoes a safety inspection. After passing the review, the team makes two runs over a 0.7-mile obstacle course. Prizes are awarded on the basis of the best time to assemble and complete a run, adding in any penalty time incurred for rules infraction. The course makes its way around rockets, including a Saturn moon rocket and other space-related vehicles. The course is strewn with lunar-like obstacles, such as a lunar crater in which a full-size replica of the Lunar Excursion Module (LEM) sits. The PUC team finished in 7th place, the best showing that we have attained to date.



Experience at Stanford

Clara Kim and Tyson Kim are pursuing a Master of Science degree in Engineering specializing in Computer Engineering. They are conducting research in the area of haptic virtual reality under the supervision of Prof. Lucy Yang. This summer, together with Prof. Yang, they spent two weeks at Stanford University to gain research experience. Prof. Oussama Khatib and his research team in the Artificial Intelligence Laboratory at Stanford held



three research seminars to introduce their research in robot and haptic virtual reality. Clara and Tyson presented their research objectives and results of two on-going projects. Through the research seminars and detailed discussions with the research team (especially Francois Conti, Ph.D, and Jae Heung Park, postdoc), they gained a better understanding of the haptic virtual reality and its applications. Clara and Tyson will present their research results to the Artificial Intelligence Laboratory after they finish the current research project, and will have more research collaborations in the future.

Research Awards

Congratulations to David Roldan (left) and Cliff Teatrault (right) for receiving the **2005 American Iron and Steel Institute Medal Award** as co-authors of the paper entitled "Investigation of Tuyere Nose Failures at U.S. Steel Great Lakes B2 Blast Furnace." Dave is also one of the co-



authors for the **AIST 2006 Computer Applications Best Paper** award. Both Dave and Cliff conducted the research as part of their graduate studies in 2005. Cliff is currently working as a Mechanical Engineer at NIPSCO, and Dave is a Project Engineer at Electro-Motive Diesel (EMD) in LaGrange, IL. At EMD



he thrives to produce increasingly efficient and economical locomotives by using what he learned in college such as thermodynamics, fluid flow, heat transfer, and computational fluid dynamics.

STEEL Scholarship

Congratulations to Junior Nathan C. Street for receiving the STEEL Scholarship from The American Iron and Steel Institute (AISI) and the Association for Iron and Steel Technology Foundation (AIST). Nathan is a junior majoring in Mechanical Engineering with a GPA of 3.85. He was awarded \$5,000 and a paid summer internship with Mittal Steel USA—Burns Harbor. The purpose of the scholarship is to provide incentive for students to become involved in the steel industry. Nathan is one of ten recipients in the country this year.



More Career Choices for Purdue Calumet Engineering Graduates.



Student and Alumni News



Internship students Nicholas Kamm and Manohar Rothu, engineering alumni Baris Ulodogan and Jeff Knaack, and George Nabhan at Superior Engineering



Engineering student Marco Iacsin with Camilo Pardo, Chief Designer, and Jim Padilla, Former President of Ford Motor during his internship



Curt Schreiber, Andy Campbell, Andy Miller, Jim Majdak and Frank Ursetta are engineering graduate students and employees of Hadady Corp.

More Engineering Internships and High Paying Jobs

Engineering departments have frequently been contacted by companies for internship and job opportunities. The number of engineering students participating in internships has increased significantly. These internships provide students with great opportunities for paid job experience with potential employers, and employers an opportunity to evaluate potential employees. The following is an example of a student who has benefited from an internship and received a high-paying job.

Name: Abhinav Mithal

Degree: Master of Science in Engineering specializing in Electrical Engineering

Job Title and Company: Software Engineer, Aylus Networks, Inc, Westford, MA

Job Description: Develop cell phone applications like “look who you are talking to.” New method of throwing advertisements using a newly developed technology in cell phone hand sets.

How did Purdue Calumet Help Me to Get a Job/Career: “I worked as a research assistant under Prof. Zhou & Prof. Hentea. This work dramatically changed how I approached problems and their resolution. It also gave me an opportunity to know beyond what books say. As a result, I was able to go on an internship at Bluespec Inc. in Waltham, MA. This internship, combined with research experience and the knowledge gained from graduate courses at Purdue Calumet, opened the gates to numerous jobs for me.”

Sargent & Lundy Shadow Day

As published in Sargent & Lundy's employee newsletter

Ten junior and senior engineering students from Purdue University Calumet visited Sargent & Lundy on January 27 to learn about the power engineering profession. The visit was initiated by Senior VP Bob Presnak, FPT, a Purdue Calumet alum who is active on the university's Engineering School Advisory Board. The students were introduced to S&L by Pam Petrich, HR, and Bob then explained our project



team approach and how we do work and build client relationships. S&L's design tools were demonstrated by Jeff Mendelsberg and Vinton Trowbridge of ESDID, with an emphasis on the role of the engineer in the design process. The group was also introduced to the types of projects a power engineer can work on. FPT Purdue alumni Paul Hoornaert and Andrea Massa discussed the Big Bend SCR project while Gary Ault and Yan Kong discussed the Noblesville repowering project. The students reported that they thought the visit was quite worthwhile and were impressed with the types of projects that our engineers are involved in as well as our facilities & technology. Several of the students indicated an interest in pursuing career opportunities at S&L after their first-hand introduction to our company.

More Demand for Qualified Engineers.

Summer Engineering Program for High School Students



HAMMOND, Ind. – Fifteen local middle to high school students participated in a five-week summer program at Purdue University Calumet to explore various types of engineering, and applications of math and science to problem solving in engineering and science, including laboratory and computer experiences. The participants learned from hands-on activities such as hardware configuration, network administration and troubleshooting, and projects involving fluid mechanics and special effects video projects. The students took field trips to local industries such as Northern Indiana Public Service Co., Gary Sanitary District, and the Museum of Science and Industry, to teach students about engineering and its relation to the community. Students also had access to Purdue Calumet facilities used in engineering education. The program is not solely to learn about engineering. George Nnanna, the director of the program and Purdue Calumet assistant professor of mechanical engineering, believes the program helps interest participant in future educational plans. “Students are introduced to scientific topics, mathematical tools to solve appropriate scientific problems, hands-on laboratory experience that reinforces and applies the concepts, and use with computer engineering/scientific software to solve relevant problems.” “The goal of the program is to expose students to engineering to help them decide if this may be what they want to pursue in the future,” Nnanna said. The program has proved successful in recruiting students to institutions of higher learning including Purdue University Calumet. Five students from this year's program plan to attend Purdue Calumet. Started at Purdue Calumet in 1991 by Prof. Ed Pierson, the program has been sponsored for the last three years by Workforce Development Services, Inc, Gary, Indiana.

Written by University Relation student intern Angel Lopez III

New ME Lab

An exciting new computer lab was established in the Mechanical Engineering Department in Summer 2006. A state-of-the-art computing laboratory including 20 stations and a variety of software packages specifically required for Mechanical Engineering, such as Fluent for computational fluid dynamics, ANSYS for finite element analysis, MATLAB, and 3-D solid modeling tools. This lab is in response to a suggestion made by one of our graduates during the exit survey. It is now open to mechanical engineering students for their course studies and research projects.

Engineering Graduate Program News

Our engineering graduate program is still growing. Currently, there are more than 80 students pursuing their Master of Science in Engineering (MSE) degrees. There are a variety of courses offered in the specialized areas of computer engineering, electrical engineering, and mechanical engineering. Streaming video courses offered by Purdue Professional Engineering Education are also available to our students. For more detailed information on our engineering graduate program, please visit <http://www.calumet.purdue.edu/engr/enrgradprogram.html>

ECE Control Lab

The control system laboratory is part of ECE 384 / ME 485 - Linear Control Systems. The goal of the laboratory is to introduce students to system modeling and control theory. Students will use MATLAB, Simulink, and the Control System Toolbox to perform a number of cyber exploration laboratory assignments and practical experiments. The assignments deal with evaluation of system time response, reduction of multiple systems, stability, effect of loop gain and system type upon steady-state errors, and control design via root locus. In addition to cyber assignments, practical experiments include performing I/O using a DAQ board, developing a feedback control system for heating/cooling of a metal plate, controlling the quantity of water in a bucket, and the PID control of an industrial emulator. The control laboratory provides another platform for students to do hands-on experiments and develop skills needed in industry.



Alumni / Employer Survey

Dear Alumni and Employers of our Graduates: We are conducting an Alumni/Employer survey to help us improve our program, and thus to better serve you in the future. Please take a few moments to complete the survey on the Website: <http://engineering.calumet.purdue.edu/survey> (The password is engineering). We appreciate your willingness to help us, and assure you that all information is confidential.

Recognized in U.S. News & World Report.

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Faculty News



Prof. H. Gerber works with a student on a multimillion dollar interdisciplinary project to investigate RF Bio Effects



Prof. Y. Kin and student conducts a fatigue experiment



Professor X. Yang and students demonstrate a Virtual Reality Project

Professor Ed Pierson receives Outstanding Faculty Service Award, 2005-2006



Professor Ed Pierson has made significant contributions to engineering departments, the school, and the university since the day he started at Purdue University Calumet in 1982. Through the Purdue Calumet Engineering and Science Summer Program and national Junior Engineering Technical Society Tests of Engineering Aptitude, Mathematics and Science (JETS – TEAMS), Prof. Pierson has advanced and directed campus programs and opportunities that promote learning and application of engineering and science among diverse school-age students. He also

has attracted professionals to campus to participate in workshops and national conferences. Additionally, he participates in a music ensemble that performs at Commencement Exercises.

Faculty Collaborate with Steel Industry Researchers and Receive Awards

Engineering faculty and graduates from Purdue University Calumet, and researchers from U.S. Steel Corp. and Mittal Steel Co. recently collaborated on projects and received awards for their steel industry research.

Chenn Zhou, Purdue Calumet head and professor of mechanical engineering; David Roldan and Clifford Tetrault, engineering master's degree alumni; Yongfu Zhao and Mark Atkinson of the Research & Technology Center of U.S. Steel Corp.; and Hugh E. Crosman of the Great Lakes Works of U.S. Steel Corp. recently received the American Iron and Steel Institute (AISI) Medal Award. The AISI Medal Award was presented for the paper "Investigation of Tuyere Nose Failures at U.S. Steel Great Lakes B2 Blast Furnace" at the AISI General Meeting in Boca Raton, Fla. The AISI Medal Award was established in 1927 to perpetuate the memory of the late Elbert H. Gary, AISI founder and first president, and to stimulate improvement in the iron and steel and allied industries. The medal is awarded annually for a technical paper having special merit and importance in connection with the activities and interests of the iron and steel industry.

Also, Zhou; Roldan; Fang Yan, Purdue Calumet research associate; D. "Frank" Huang and Pinakin Chaubal of Mittal Steel Co.; and Yongfu Zhao of U.S. Steel Corp. received the American Iron and Steel Technology (AIST) Association 2006 Computer Applications Best Paper Award. The award was presented for the paper "Evaluation of Internal Conditions in a Blast Furnace Hearting Using a 3-D CFD Model" at AISTech 2006 in Cleveland. The AIST Computer Applications Best Paper Award, established in 2005, is presented to the author of a paper selected by the AIST Process Automation and Control Technology Division, and judged by the Computer Applications Operating Committee.



Professor Zhou with Mr. John, US Steel CEO, and Dr. Atkinson of US Steel at the AISI Award Ceremony



Dr. Chaubal and Dr. Huang of Mittal Steel at the AIST Award Ceremony

Distinguished Faculty.

Productive Professors...

Dr. George Nnanna, Assistant Professor of Mechanical Engineering, is very active in nanotechnology research and publications. His most recent work will appear in the prestigious *Journal of Heat Transfer* and has been described by reviewers as a "complete piece of work," and "may be the **first** reported experimental study of natural convection heat transfer in nanofluid." He is very active in reviewing proposals and journal papers, as well as chairing technical sessions at national and international conferences.



Recent Publications

- ◆ A. G. Agwu Nnanna, 2007, "Experimental Model of Temperature-Driven Nanofluid, HT05-1270," *Journal of Heat Transfer*, June 2007 issue.
- ◆ A. G. Agwu Nnanna, 2006, "Application of Refrigeration System to Electronics Cooling," *Journal of Applied Thermal Engineering*, Vol. 26, No. 1, pp. 18-27.
- ◆ G. Agwu Nnanna, A. Haji-Sheikh, and K. T. Harris, 2005, "An Experimental Study of Non-Fourier Thermal Response in Porous Media," *Journal of Porous Media*, Vol. 8, No. 1, pp. 31-44.
- ◆ A. G. Agwu Nnanna, and A. Haji-Sheikh, 2005, "Sensitivity Coefficients for Analyzing Interstitial Properties during Phase Change in Porous Media," *Journal of Inverse Problems in Science and Engineering*, Vol. 13, No. 6, pp. 595-616.
- ◆ M. Routhu, and A. G. Agwu Nnanna, 2006, Mathematical Formulation of Transport Phenomena in Buoyancy-Driven Nanofluid," *Proceedings of the ASME Int. Mechanical Engineering Congress and Exposition*, No. IMECE2006-13268, accepted for publication, Nov. 5-10, Chicago, Illinois.
- ◆ A. G. Agwu Nnanna, 2005, "Nanoparticle Concentration in Buoyancy Flow," *Proceedings of the ASME Int. Mechanical Engineering Congress and Exposition*, No. IMECE2005-79364, Orlando, Florida, Nov. 5-11, 2005.
- ◆ A. G. Agwu Nnanna and Manohar Routhu, 2005, "Transport Phenomena in Buoyancy-Driven Nanofluids - Part II," *Proceedings of the ASME Summer Heat Transfer Conference*, No. SHTC-72782, San Francisco, CA, July, 2005.
- ◆ A. G. Agwu Nnanna, 2005, "Thermo-hydrodynamic characterization of nanofluidics in micro-channel," *Euromech Colloquium 472 on Microfluidics and Transfer*, September 6-8, 2005, Grenoble, France
- ◆ A. G. Agwu Nnanna, A. Haji-Sheikh, and K. T. Harris, 2004, "Experimental Study of Local Thermal Non-Equilibrium Phenomena during Phase Change in Porous Media," *International Journal of Heat and Mass Transfer*, Vol. 47, pp. 4365-4375.

Awards:

- ◆ "Experimental Investigation of Transport Phenomena in Buoyancy-Driven Nanofluids," 2004, NSF Grant # CTS-0404493
- ◆ "Ralston Street Lagoon Project," 2006, **Gary Sanitary District**
- ◆ "Thermoelectric Refrigeration System using Nanofluid," 2006, **ASHRAE**
- ◆ "Design, Construction, and Testing of Smart Air Distribution System for Cooling of Data Centers," 2004, **ASHRAE**
- ◆ "Design, Construction, and Application of Vapor Compression Refrigeration Unit (VCRU) to Cool High Heat Flux Electronics," **ASHRAE**



Dr. Dave

Kozel, Associate Professor of Electrical Engineering, is dedicated to undergraduate student research. He has supervised a number of student projects in the areas of Digital Signal Processing, and Energy. Examples include:

Ambulance Siren Noise Cancellation Using Adaptive Filtering Techniques, Noise Reduction for 911 Calls, Wireless Seizure Monitor, Regenerative Braking to Conserve Energy in Electric Vehicles, Automatic Lighting Control, and Solar Powered

Battery Charger for Disaster Relief.

Dr. Harvey Abramowitz, Professor of Mechanical Engineering, has received the following grants:

- ◆ \$385,000 for computer science, engineering, and mathematics scholarship program by the National Science Foundation.
- ◆ \$1,200 for development of etchant for new stainless steels funded by Questek Innovations LLC.
- ◆ \$34,480.00 for development strategies for the utilization of Indiana coal slurry ponds funded by the Clean Coal Technology Research Center at Purdue West Lafayette.
- ◆ \$10,000 for 3D visualization of ternary diagrams funded by the Ameri-

can Iron & Steel Institute.

- ◆ \$150,000.00 for ferrous metallurgy grant program funded by Association of Iron and Steel Technology (formerly Iron and Steel Society).
- ◆ \$6,000.00 for Moonbuggy 2007 funded by the Indiana Space Grant Consortium

Dr. K. Gopal Gopalan,

Professor of Computer and Electrical Engineering, was awarded a U.S. patent for "A Technique for Embedding Data in Audio Signals", with D. Benincasa (AFRL, Rome, NY), Patent No. 7,035,700, April 25, 2006.



Dedicated to both Teaching and Research.