



Research Capabilities College of Engineering, Architecture and Technology (CEAT) Oklahoma State University 2008

The College of Engineering, Architecture, and Technology (CEAT) consists of the six schools of Engineering, the School of Architecture, and the Division of Engineering Technology. CEAT offers a broad spectrum of educational, research, and outreach opportunities designed to meet the technological needs of a modern society. Its faculty members have consistently achieved excellence in the classroom while directing research programs that rank among the best in the nation. This is only possible because of an outstanding faculty and their commitment to excellence.

Information about CEAT and its research programs is available through the CEAT Office of Research Administration, 201 Advanced Technology Research Center, Oklahoma State University, Stillwater, OK 74078, (405) 744-5957 or at <http://www.ceat.okstate.edu>

Laboratories and Centers

Advanced Controls Laboratory, Dr. Eduardo Misawa, (405) 744-5900.

<http://acl.okstate.edu/>

Laboratory Objectives: 1) Research on theory and application of analysis, identification, estimation and robust control methodologies for uncertain nonlinear systems, with guaranteed stability and performance properties. 2) Application of these theories on engineering systems, with special emphasis on electro-mechanical and electro-hydraulic systems. 3) Integration of research and teaching in the field of systems and control. 4) Foster growth of all laboratory members through active research, seminars, workshops, informal discussions, publications and participation in major systems and control conferences.

Advanced Manufacturing Processes and Nano Materials Laboratory, Ranga Komanduri, (405) 744-5900.

The facilities in advanced manufacturing processes and materials laboratory (AMPML) are rather unique and most of the equipment is state-of-the art. The research activities include finishing of advanced ceramics, glasses, and other difficult-to-finish materials, thermal aspects of various manufacturing processes, laser assisted material processing, high-speed machining, MD simulation of nanometric cutting and tribology, and hard coatings on cutting tool for improved wear resistance.

Bioengineering Laboratory, Dr. Sundar Madihally and Dr. Heather Fahlenkamp, (405) 744-5280 <http://www.cheng.okstate.edu/faculty/gasem.htm>

State of the art facilities in the Advanced Technology Research Center provide the home for the Bio-Engineering Laboratory. Efforts in this lab are using biological process and adult stem cells to searching for cures to the devastating illnesses, new materials, and alternative energy sources. Other efforts include new techniques for medical imaging and automated image analysis.

Building and Environmental Thermal Systems Research Group, Dr. Daniel Fisher and Dr. Jeffrey Spitler, (405) 744-5900.

<http://www.hvac.okstate.edu/>

The Building and Environmental Thermal Systems Research Group of Oklahoma State University is made up of researchers with special interests in building heat transfer, HVAC systems modeling, building energy simulation, hydronic heating systems, geothermal heat pump systems and ground loop heat exchanger technology. Some research projects include: Experimental Validation of Heat Balance and RTS Cooling Load Procedures; The Geothermal Smart Bridge; Simulation of Building Systems; Development of an Analytical Verification Test Suite for Whole Building Energy Simulation Programs – Building Fabric; and Development of a Two-Dimensional Transient Model of Snow-Melting Systems.

Center for Computer Integrated Manufacturing, Dr. Manjunath Kamath, (405) 744-6055

<http://www.okstate.edu/cocim/index.html>

The mission of the Center for CIM is to make fundamental contributions to the science base for modeling, analysis, design, operation, integration and continuous improvement of manufacturing enterprises. The current focus is on developing the next generation of enterprise modeling frameworks and languages to model both business and technical processes in a unified manner. Faculty from the industrial engineering, MIS, and accounting are involved in a project recently funded by NSF. Other topics that are being explored include modeling and analysis of supply chain systems, electronic enterprise laboratory to support instruction in the information systems area, and the design of flexible shop floor control systems.

Center for Logistics and Distribution (CELDi), Dr. Ricki Ingalls, (405) 744-6055

CELDi is an NSF/Industry/Academia partnership to study issues related to logistics and distribution. Academic partners include the University of Arkansas and the University of Oklahoma. CELDi is unique in that only problems proposed by the industrial partners are considered for study.

Computational AeroServo Elasticity (CASE) Laboratory, Dr. Any Arena, (405) 744-5900

<http://www.caselab.okstate.edu/>

In cooperation with researchers at NASA Dryden Flight Research Center, an effort is underway in predicting aeroelastic behavior of arbitrary aircraft configurations. Computational Fluid Dynamic (CFD) solutions are coupled together with structural motion equations in order to predict aeroelastic and aeroservoelastic effects over a wide range of Mach numbers from subsonic to hypersonic speeds. Of particular interest is the ability to predict aeroelastic flutter boundaries in a time-efficient manner on workstation computers in order to support flight-test operations.

Computer Architecture Group, Dr James Stine, Dr. Louis Johnson and Dr. Weihua Sheng, (405) 744-5151

<http://www.vcag.ecen.okstate.edu/>

OSU has an active research program in the area of computer architecture and building of components that comprise system on chip (SOC) systems. Some of the areas of emphasis include prefetching, cache design, computer arithmetic systems, applications-specific architectures, compilers and hardware for enhanced floating-point performance, and cryptographic hardware. OSU is also involved in designing state of the art tools that allow complex architectures to be created that comprise billions of transistors.

Daylighting Laboratory, Dr. Khaled Mansy, (405) 744-6444

<http://architecture.ceat.okstate.edu/people/AE/mansey.htm>

Under NSF sponsorship, an artificial sky dome has been constructed that allows the study of daylighting conditions. The lab is used for research and undergraduate instruction.

Geothermal Heat Pump Research Laboratory, Dr. Jim Bose, (405) 744-9370/9368

Research performed at the GHPR Laboratory is dedicated to advancing the technology of geothermal heat pump connected systems. Researchers are involved in extending GHP technology by designing and developing experimental systems to provide data to develop models, by investigating and developing methodology, and through product verification and development. The 18.5 acre Laboratory site has test systems which include horizontal and vertical ground loop performance tests, horizontal backfill investigations, grout performance in vertical boreholes, vertical borehole heat exchanger enhancements, shallow heat rejection studies, in-situ thermal conductivity testing, Slinky heat exchanger bench test, pond loops, flat plate heat exchangers in a vault, and a 20 ft by 60 ft Smart Bridge system for deck deicing studies. Researchers also participate in IGSHPA training for the industry using the Laboratory facilities. In the month of May each year GHP demonstrations take place at the Laboratory on the third day of the IGSHPA Technical Conference and Exposition.

<http://www.geothermal.okstate.edu/>

For extended and integrated activities see <http://www.hvac.okstate.edu/> and

<http://www.igshpa.okstate.edu/>.

Hydrodynamics and Aerodynamics Laboratory, Dr. Jamey Jacobs, (405) 744-5900

<http://hal.ceat.okstate.edu/HAL/Research.html>

HAL is dedicated to state-of-the-art research in aerospace engineering and fluid mechanics. Current project include: Plasma Based Flow Control, including Plasma Synthetic Jet Actuators; Development of Inflatable Wings for UAVs; Active Separation Flow Control; Vortex Wake Merger and Mitigation; and Development of a Systemic-Pulmonary Artery Shunt

Intelligent Systems and Controls Laboratory, Dr. Marty Hagen and Dr. Gary Yen, (405) 744-5151

http://www.ece.okstate.edu/Research/Intelligent_systems/index.html

With its traditional base of supporting statewide industry, it is not surprising that OSU has a strong interdisciplinary program in control systems engineering. Current research projects focus on predicting impending failures in complex interrelated structures, using assessment tools using

emerging neural network and fuzzy logic technology. Additional work involves neural network based intelligent controllers capable of self-optimization, on-line adaptation and autonomous fault detection and controller reconfiguration.

Micro Flow Laboratory, Dr. Khaled Sallam, (405) 744-5900

<http://www.microflowlab.okstate.edu/>

The Research in the Micro Flow lab is focused on fluid dynamics and multiphase flow at the micro and nano scale to develop advanced systems for flow, propulsion and biomedical applications. The experimental studies are conducted using different laser diagnostic techniques (double-pulsed digital holography, particle image velocimetry & shadowgraphy), scanning electron microscopy and high speed imaging. The equipment in the lab include: Two Nd-YAG lasers with an injection seeder (300mJ/Pulse), a dual head PIV Nd-YAG laser (70mJ/pulse), cooled double exposure CCD camera (2000 pix x 2000 pix), a high speed camera (20,000 fps), 50 kV DC Source, two subsonic wind tunnels with test sections of 18"x18" and 12"x12" and a 40ft long shock tube. The computational studies in the lab are carried out using VOF and LBM simulation.

Mini/Micro Channel Heat Transfer Laboratory, Dr. Afshin Ghajar, (405) 744-5900

<http://ghajar.ceat.okstate.edu/ghajar.html>

This laboratory was established in 2004 with the help of a three-year grant from the Sandia National Laboratory/US Department of Energy. The focus of the laboratory is to conduct research in fluid flow and heat transfer issues related to flow in passages 3 mm to about 10 micrometer. The objective of our current investigation is to characterize, experimentally and analytically, the hydrodynamic and thermal parameters of single and two-phase flows in mini/micro channels with high heat fluxes.

Nano Fabrication Laboratory, Dr. James Smay, (405) 744-5280

<http://www.cheng.okstate.edu/faculty/smay.htm>

Issues related to the designed, optimization, production, and application of nano scale devices are being explored in the newly established Nano Fabrication Lab. The initial focus of the lab is on devices that can serve as high-resolution sensors with very low rates of false readings and on dental implants.

New Product Development Center, Dr. Ranji Vaidyanathan, (405) 744-5134

<http://www.npdc.okstate.edu/>

The New Product Development Center links the resources of Oklahoma State University's faculty, staff and students to help Oklahoma's small manufacturers thrive in today's market. The NPDC focuses on working with established manufacturers to create new jobs and revenue. Each project is an investment for the future of Oklahoma.

Oklahoma Industrial Assessment Center, Dr. William J. Kolarik, (405) 744-6055.

<http://www.okstate.edu/ind-engr/oia/okiac.htm>

The Oklahoma State University Industrial Assessment Center is funded by the US Department of Energy as a part of a national program to perform no-cost energy audits for small to medium sized industries.

Oklahoma Transportation Center, for information contact Dr. Alan Tree, (405) 744-5957.
<http://www.oktc.org/OTCv2/>

The Oklahoma Transportation Center (OTC) is a multi-disciplinary coalition of the Oklahoma State University (OSU), the University of Oklahoma (OU), and Langston University (LU) to serve as a resource for solving critical transportation problems in the State and in the nation in a cooperative manner. Founded in 2001, the OTC has over 30 "founding partners" including Oklahoma Department of Transportation (ODOT), Oklahoma Turnpike Authority (OTA), and companies and associations representing all transportation modes.

OSU Robotics Laboratory, Dr. Lawrence L. Hoberock, Dr. Prabhakar Pagilla (405) 744-5900 and Dr. Gary Yen (405) 744-5151

<http://www.mae.okstate.edu/research/robotics/robotics.html>

The objective of the OSU Robotics Laboratory is to provide facilities and support for research and development in applied robotic systems. Facilities include experimental robot test-beds, several machine vision systems, complete integrated robot/vision/material handling systems, a variety of sensors, and supporting personal computer hardware and software for on-line and off-line computation. Some research areas in this lab include: Modeling, Control Design and Mechatronic Implementation of Constrained Robots; Adaptive Control of Time-Varying Mechanical Systems; Robot Design for Large, Automated Dishwashing Operations; Silverware Separation, Sorting, and Inspection; Intelligent Control Systems; Intelligent Learning and Control of Multiple Interacting Robots.

Phase Equilibria Thermodynamics and Process Development Laboratory, Dr. Khaled Gasem, (405) 744-5180 <http://www.cheng.okstate.edu/faculty/gasem.htm>

Equilibrium phase behavior and the resultant thermodynamic properties are a manifestation of molecular interactions. Therefore, efforts to account for such interactions in developing thermodynamic models are essential. The thermodynamics research program encompasses studies in theory, experimentation, algorithm development, and computer simulations to permit effective modeling of the phase behavior of targeted applications. Further, thermodynamic property prediction is an interplay among the theoretical framework stemming from the laws of thermodynamics, equation-of-state (EOS) models that describe the phase behavior of the molecular species involved, and the numerical algorithms implemented. Accordingly, successful predictions of thermodynamic properties are realized only when clear objectives are stated, appropriate methods are used, and a critical evaluation of the results is conducted.

Real-Time Distributed Systems Laboratory, Dr. Martin T. Hagan, (405) 744-7340.

<http://www.ceat.okstate.edu/research/11.html>

A laboratory to support educational, research, and developmental efforts in real-time distributed systems has been created at OSU. Real-time systems are those, which must interact with the outside world on terms that are dictated by events taking place there. The computations that are done in response to those events must not only produce the correct results, but they must also produce those results at the correct time.

Single/Two-Phase Heat Transfer Laboratory, Dr. Afshin Ghajar, (405) 744-5900

<http://ghajar.ceat.okstate.edu/ghajar.html>

This laboratory was established in 1988 with the help of a three-year research grant from the National Science Foundation (NSF). Over the life of the laboratory, our work has focused on fundamental and applied research in convective heat transfer. The work extends to many areas of the thermal sciences field, including heat transfer and pressure drop in viscoelastic fluids, stratified thermal storage, heat transfer in liquid and air-cooled electronic equipment, mixed convective heat transfer and pressure drop in tubes in the transition region with different inlet configurations, and more recently two-phase heat transfer and pressure drop in horizontal and inclined tubes. In 2001 the laboratory's equipments, data acquisition system, and computing facilities were extensively upgraded through generous grants provided by Micro Motion, National Instruments, Omega, Dell Computers, and Oklahoma State University Foundation.

Speech and Audio Processing Laboratory, Dr. Keith Teague, (405) 744-5170.

http://spiff.ecen.okstate.edu/spac/sapl/sapl_lab.htm

This laboratory supports the digitization, processing, analysis and synthesis, display, and playback of audio bandwidth signals. Another feature of the laboratory is the support of Real-time algorithm development on signal processing development systems.

Robust Electromagnetic Field Testing and Simulation Lab, Dr. Chuck Bunting and Dr. Jim West, (405) 744-5151

<http://reverb.okstate.edu>

Research in computational E&M is becoming more and more closely tied to wireless communications, and high speed computer design. At OSU current research programs focus on the use of computational electro-magnetics to determine radar scattering of radar from rough surfaces.

Ultrafast Terahertz Laboratory, Dr. Daniel R. Grischkowsky, Dr. R. Alan Cheville, Dr. Weili Zhang (405) 744-6622.

<http://elec-engr.okstate.edu/utol/>

The Ultrafast Terahertz-Optoelectronic Laboratories is a unique Oklahoma resource- combining the technology of microscopic fabrication with existing laser expertise to solve real, immediate, and practical problems facing the technical community. The capabilities developed in our laboratory are enabling- we actively encourage qualified researchers to collaborate on projects of mutual interest. The Ultrafast Terahertz-Optoelectronic Laboratory also takes pride in training students to face the problems of the next century. The knowledge and practical, hands-on experience students will gain in optics and microscopic fabrication is the basis for the technologies that will dominate the next thirty years.

Ultraprecision Surfaces Laboratory, Dr. Don A. Lucca, (405) 744-5900.

The research work of the laboratory is focused on: 1.) creation of ultraprecision surfaces by techniques such as nanocutting, ultraprecision machining, and chemomechanical polishing, 2.) the subsequent characterization of both the surface and near surface condition in terms of topography, chemistry, mechanical properties (elastic modulus, hardness, active slip systems), and lattice order/disorder.

Ultrapure Water Research Group, Dr. Gary L. Foutch, (405) 744-5280.

<http://www.cheng.okstate.edu/upw/>

The Research Group works to develop computer programs that can predict the performance of water processing equipment. Most of our work to date has focused on mixed-bed ion exchange (deionization). We work closely with industry, and use data from actual plants to test our computer models. We are sponsored by many industrial end-users of ultrapure water, and host an annual meeting to get their feedback on our work.

Visual Communication and Image Processing Lab, Dr. Guoliang Fan, (405) 744-1547

<http://www.vcipl.okstate.edu/>

The Visual Communication and Image Processing Lab (VCIPL) is equipped with state-of-the-art computing and imaging facilities. VCIPL has wide interests in various visual information-related signal-processing techniques, i.e., digital image/video processing and Multimedia. The research in VCIPL will cover both the fundamental image representation and processing techniques and other visual information-related applications, including: statistical image modeling and processing, applications to remote sensing and medical imaging, and Internet-based visual communication, etc.

VLSI, Dr. Chris Hutchins, (405) 744-5151

<http://www.ece.okstate.edu/People/hutchens.html>

Mixed mode CMOS VLSI including analog, MIMS and digital electronics, sensor/transducer systems and biomedical engineering. High speed and low power CMOS analog to digital converters (ADC) and digital to analog converters (DAC) on deep submicron thin film Silicon CMOS. Design of large geometry (in excess of 1mm width transistors) short channel transistors for GHz applications. Microelectromechanical systems (MEMS) transducers and transducer amplifiers. Current efforts include: a low power sigma delta and several 4 bit GHz flash ADCs, a 4 bit DAC and a MEMS chopper amplifier for an integrated power meter.

Web Handling Research Center, Dean Karl N. Reid, (405) 744-5140.

<http://www.engext.okstate.edu/>

The mission of the Web Handling Research Center (WHRC) is to advance the knowledge base in technologies applicable to the transport and control of continuous-strip materials. Primary activities include fundamental and generic research, as well as knowledge and information transfer to and from its industrial sponsors.