

# Balsells Foundation Fellowship

## **Samples of UCCS EAS Faculty Research Areas**

### **Electrical and Computer Engineering**

#### **Dr. T. Kalkur**

Adaptive electronics circuits with tunable ferroelectric capacitors, tunable multiband antennas, bulk acoustic wave resonators with tunable dielectrics, environmental health monitoring using surface acoustic wave sensors, Thermally robust bipolar integrated circuit design with feedback, spread spectrum clocks, Polarization switched DC-DC converters, tunable filters with graded Ferroelectric films and MEMS.

#### **Dr. Willie K. Harrison**

Dr. Harrison's main research interests include physical-layer security, secrecy codes, and cryptography. In a general sense, he is also interested in information theory, channel and source coding, signal processing, and telecommunications. He is currently working on the information-theoretical security analysis of cryptographic protocols when an attacker only has access to error-prone encrypted text, and secrecy coding for low-power sensor networks.

#### **Dr. Heather Song**

Dr. Song's research area include RF/Microwave systems, high power microwave and millimeter-wave vacuum electronics, microwave power modules (MPMs), antenna and phased array, power combining techniques, microwave plasma systems, medical technology using microwave applications, and Terahertz electronics. Recent research projects include development of a power combined millimeter-wave power module employing traveling-wave tubes, novel microfabricated slow-wave structures, and terahertz sources for security and communication applications.

### **Dr. Gregory Plett and Dr. Scott Trimboli**

Drs. Plett and Trimboli are focused on research in control systems as applied to the management and control of high-capacity battery systems, such as found in hybrid and electric vehicles. Current research efforts include: physics-based reduced-order modeling of ideal lithium-ion dynamics; system identification of physics-based model parameters using only current-voltage input-output data; physics-based reduced-order modeling of degradation mechanisms in electrochemical cells; estimation of cell internal state and degradation state; state-of-charge, state-of-health and state-of-life estimation; power and energy prediction using model predictive control and other advanced techniques to extend life; battery pack fast charging. Research is both theoretical and empirical: the UCCS high-capacity battery research and test laboratory houses equipment to test cells, modules, and battery packs, and is home to our own custom battery-management system and our own battery pack simulator projects, which enable cutting-edge research in advanced but practical algorithm prototyping. See <http://mocha-java.uccs.edu/HCBRTL/> and <http://mocha-java.uccs.edu/IDEATE/> for more information regarding the test laboratory and our educational offerings.

## **Computer Science**

### **Dr. Xiaobo Zhou**

Dr. Zhou's research lies broadly in computer network systems, more specifically, autonomic and sustainable computing in datacenters, Cloud computing, server virtualization, scalable Internet services and architectures, and computer network security. He directs the Distributed, Sustainable, and Cloud Computing (DISCO) Lab, which aims to explore in-depth understanding of Distributed, Internet and Cloud computing systems and services and develop innovative technologies to enhance the system performance, dependability, and sustainability. The research was supported in part by funding from the National Science Foundation including the prestigious CAREER award and the Air Force Research Lab. The DISCO lab is located in the new science and engineering building. The server room is furnished with cutting-edge HP data center blade facility that has three racks of HP ProLiant BL460C G6 blade server modules and a 40 TB HP EVA storage area network with 10 Gbps Ethernet and 8 Gbps Fibre/iSCSI dual channels. More information at <http://www.cs.uccs.edu/~xzhou/DISCO/>.

### **Dr. Chuan Yue**

Current research focuses on Cyber Security, Computer and Information Security, and Web-based Systems. His research interests also include Human-Computer Interaction, Collaborative Computing, Distributed and Parallel Computing, and Cloud Computing.

### **Dr. Qing Yi**

Areas of research interests include compilers and programming languages, particularly compiler optimizations for high performance computing and tools for automatically improving software productivity, correctness, performance, and energy efficiency. She is the recipient of several multi-year NSF grants, including the prestigious NSF CAREER award, and her ongoing research projects include the development of a Programming Interface And Runtime For Self-Tuning Scalable C/C++ Data Structures, a multilayer code synthesis framework to enhance both the correctness and performance of software applications, and a programmable code optimization and empirical tuning infrastructure for high end computing. Details of these projects can be found at <http://cs.uccs.edu/~qyi/research.htm>.

### **Dr. Kristen Walcott-Justice**

The research of Kristen Walcott-Justice is in the area of software engineering techniques and practices. Primarily, her research focuses on software testing and debugging. Her most current work analyzes how hardware can be monitored for more efficient testing and debugging, and how hardware monitoring can be used to enable testing of programs on mobile devices.

## **Mechanical and Aerospace Engineering**

### **Dr. Andrew Ketsdever**

Dr. Andrew came to UCCS from the [Air Force Research Laboratory's \(AFRL\) Propulsion Directorate](#) at [Edwards Air Force Base](#) in California. While at AFRL, he was the group leader of the Advanced Concepts Group – a group responsible for identifying and developing the next generation of propulsion systems to enable future Air Force missions. Dr. Ketsdever has worked in the areas of advanced propulsion design and testing, rarefied gas dynamics, microfluidics, micropropulsion and spacecraft-thruster interactions since starting at AFRL in 1992. He holds patents and has patents pending in the areas of micropropulsion, advanced propulsion concepts, and nano-ignition of propellants. Currently, he is Director of the CLEER (Center for Laser, Energy, and Exploration Research) at UCCS --- developing high quality interdisciplinary research and educational programs focused on laser, energy, and exploration research and technology.

### **Dr. Michael Calvisi**

The mission of Dr. Calvisi's Computational Fluid Dynamics (CFD) Lab is to apply advanced computational methods to the study of fundamental fluid flow phenomena and their applications. The lab has a strong emphasis on studying multiphase and interfacial flows, particularly as relates to applications in biomedicine and energy systems. Current projects include investigations into the interaction of microbubble contrast agents with ultrasound, modeling of cavitation in ionic liquids, and understanding fluid-structure

interaction in intracranial aneurysms. More information can be found on the CFD Lab at <http://www.eas.uccs.edu/mcalvisi/cfdlab.html>

**Dr. Steven Tragesser**

Areas of research merges physics-based models of human motion with computer optimization algorithms to improve performance in highly skilled applications such as elite athletics, locomotion in low-gravity environments, and rehabilitation. Multi-link mechanics with joint torque actuation is used to model the kinetics of the musculoskeletal system. Numerical optimization is then employed to suggest control strategies that improve performance (e.g. speed or efficiency) or minimize loading (e.g. to mitigate the effects of an injury or disability). Dr. Tragesser also analyzes the dynamics and control of tethered spacecraft, which are also modeled using multi-link kinetics.

**Dr. Rebecca Webb**

Diminishing natural resources, dependence on foreign nations for fuel, and pollution dictate the need for alternative energy sources, but until renewable energy options are more efficient, they will not be a viable solution. Dr. Webb is the director of the Sustainable Energy Collection and Transport (SECanT) Laboratory. The principal objective of SECanT is to advance solar thermal energy collection and storage technologies. SECanT work includes complementary experimental and computational studies designed to increase fundamental understanding of solar thermal processes. We work on both applied and basic research in these areas.