Funding Sources

Research funding comes from a large array of federal agencies and laboratories including National Science Foundation, Defense Advanced Research Project Agency, Army Research Office, Office of Naval Research, Air Force Office of Scientific Research, Department of Energy, Department of Transportation, Department of Education, National Institutes of Health, Air Force Research Laboratory, Sandia National Laboratories, as well as state agencies, industrial companies, not-for-profit organizations, and individuals. Approximately $5 million in research funding is obtained annually from external sources. The Center also receives university funding for support of the director, secretarial staff, graduate students, and departmental operating expenses.

ISC Initiated National Research Centers

As a result of funding from the National Science Foundation and Air Force Research Laboratory, ISC investigators have established the Center for Aerospace Manufacturing Technologies and a multi-campus site of the Engineering Research Center for Future Renewable Electric Energy Delivery and Management Systems, NSF Industry/University Cooperative Research Center on Intelligent Maintenance Systems. The Center for Aerospace Manufacturing Technologies (CAMT) serves as a national center of excellence for research, development, evaluation, demonstration, and transfer of new and optimal methodologies and tools for the rapid and cost-effective manufacture of aerospace components and products.

The research of the NSF Engineering Research Center for Future Renewable Electric Energy Delivery and Management (FREEDM) Systems aims to revolutionize the nation’s power grid and speed renewable electric-energy technologies into every home and business.

The mission of the NSF Industry/University Cooperative Research Center for Friction Stir Processing is to advance, develop and promote research into the principles and technology of Friction Stir Processing science and engineering.

The NSF Industry/University Cooperative Research Center on Intelligent Maintenance Systems aims to enable products and systems sustaining near-zero-downtime performance through the advancement of web-enabled predictive inforntics and tethert-free technologies.

Overview

The Intelligent Systems Center (ISC) performs basic and applied research to address technology needs and technical issues in developing intelligent systems for manufacturing and energy applications, and to develop generic methodologies and tools (both software and hardware) that can be applied to a wide variety of real-world problems. The Center consists of about twenty-five faculty investigators and supports the research of more than one hundred graduate students. It has state-of-the-art research laboratories distributed across the Missouri S&T campus. For more than twenty years, ISC has been working with government agencies and industrial companies. ISC is strongly affiliated with four major national research centers: the AFRL-funded Center for Aerospace Manufacturing Technologies, the NSF ERC for Future Renewable Electric Energy Delivery and Management Systems, the NSF UICRC on Intelligent Maintenance Systems, and the NSF UICRC on Friction Stir Processing.

Mission

Our Mission is to provide an interdisciplinary research environment in which faculty from various academic disciplines can cooperate and conduct joint research on sponsored projects involving real-world systems with special emphasis on the methods of sensing, control, simulation and computational intelligence and their application to manufacturing, energy, and infrastructure systems.

Goals

- Development of internationally recognized multidisciplinary research programs in intelligent systems.
- Addressing the critical needs of industry and government that require basic and applied research.
- Integration of research and education activities.
- Nurturing of faculty members through team research efforts.
- Establishment of an exciting learning environment.

Facilities

Center for Friction Stir Processing Facility
http://fisp.uicrc.mst.edu

Composite Manufacturing and Test Facility
http://mae.mst.edu/research/researchcompositematsuman.html

Embedded Systems and Networking Laboratory
http://web.mst.edu/~saranagp/

FACTS Interaction Laboratory
http://flipower.mst.edu

Integrated Systems Facility
http://web.mst.edu/~iis/

Intelligent Microsystem Laboratory
http://web.mst.edu/~clkim

Laser Aided Manufacturing Processes Laboratory
http://web.mst.edu/~lampm

Laser Based Manufacturing Laboratory
http://web.mst.edu/~laser

Smart Structures Laboratory
http://smarteng.mst.edu

Software Engineering Laboratory
http://web.mst.edu/~flu/selab.html

Structural Health Monitoring Laboratory
http://mae.mst.edu/research/researchstructuralhealthmon.html

Virtual Reality and Rapid Prototyping Laboratory
http://web.mst.edu/~vrpl

Web and Wireless Computing (W2C)
http://www.mst.edu/~cswebdc

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Intelligent Manufacturing Processes, Equipment and Systems

**OBJECTIVE**
Research is conducted towards increasing the intelligence of manufacturing processes and systems for aerospace, automotive, energy, and other applications.

Fundamental methods in modeling and simulation, sensing and control, CAD/CAM, virtual reality, and software engineering are applied to generate a better understanding of manufacturing processes and systems and to develop techniques for high-speed machining, additive fabrication, micromanufacturing, nanotechnology, etc. Research topics include:

- **VIRTUAL AND RAPID PROTOTYPING AND MANUFACTURING**
- **INTEGRATED AND COLLABORATIVE DESIGN AND MANUFACTURING**
- **LASER-BASED DEPOSITION AND PROTOTYPING**
- **COMPOSITE MANUFACTURING**
- **LASER MICROMACHINING**
- **FRICTION STIR PROCESSING**
- **LIQUID METAL PROCESSING**
- **HIGH-SPEED MACHINING AND NON-DESTRUCTIVE EVALUATION**

Laser Micromachining Friction Stir Processing

Distribution Towers Distributed Generation

Intelligent Cyber-Physical Systems

**OBJECTIVE**
To enhance the reliability, security, capacity, efficiency, and stability of cyber-physical systems.

**ADVANCED CRITICAL INFRASTRUCTURE SYSTEMS**
Distributed grid intelligence of advanced critical infrastructures such as distributed energy resources, transportation resources and water resources. Formal methods for fault-tolerance and security and reliability measurement of combined cyber and physical systems. Addressing privacy and confidentiality concerns through formal models of information flow. Demonstration systems include microgrids and renewable energy systems.

**ADVANCED SIMULATION OF CYBER-PHYSICAL SYSTEMS**
Developing embedded real-time simulation used in Hardware-in-the-Loop testbeds. Advanced compilation and parallel processing techniques.

**HARDWARE/SOFTWARE CO-DESIGN**
Determining a common semantic basis among the cyber and physical components for modeling, requirements specification, automated reasoning, model checking, and fault detection. Bridges between engineering and computing science.

MEMS and NanoSensors

**OBJECTIVE**
To create advanced measurement, simulation, communications, and control system networks.

**MEMS AND NANOSENSORS**
Design and manufacture of Microsystems and development of advanced sensors for monitoring, diagnosis, system identification, and implementation of real-time control systems.

**WIRELESS SENSOR NETWORKS**
Provide situational awareness, survivability, and security of mobile networks; modeling of high-speed networks; novel networking protocols; and network traffic management.

Virtual Reality and Advanced Simulation

**OBJECTIVE**
Integration of virtual reality technologies with domain models to train first responders, orthopedic surgeons, assembly operators, etc.

**VIRTUAL REALITY AND ADVANCED SIMULATION**
Integrating virtual reality technologies with domain models to train first responders, orthopedic surgeons, assembly operators, etc.

Intelligent and Adaptive Control

**OBJECTIVE**
Intelligent, embedded, distributed control system architectures and technologies with application to automotive, civil, electrical, and mechanical systems.

Computational Intelligence and Embedded Systems

**OBJECTIVE**
To extend the breadth, comprehensiveness, and scope of automated approaches to problems that are currently presumed to require human intelligence.

**DATA PROCESSING, FUSION, AND MANAGEMENT**
Enhancement of the ability to extract meaningful information from large bodies of data, such as bioinformatics, other biomedical data, data warehousing, and counterterrorism.

**SYSTEM DESIGN AND DECISION SUPPORT**
Applications include automated risk assessment, robot swarms, combinatorial optimization, logistics, time-series analysis, pattern recognition, and search.

**TRUSTWORTHY AND EMBEDDED HYBRID SYSTEMS**
Design of algorithms for ensuring security, responsiveness, and correctness of space applications, embedded systems, handheld applications, aerospace, and automotive systems using neural networks, signal processing methods, and fault-tolerance.

cDNA Microarray Technology