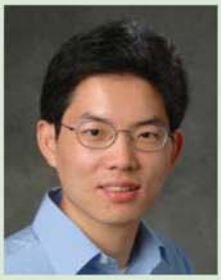
Xiaobo Tan Receives Prestigious CAREER Grant



Xiaobo Tan, assistant professor of electrical and computer engineering, received an NSF CAREER Award for his proposal "Dexterous Biomimetic Micromanipulation Using Artificial Muscles: Modeling, Sensing, and Control." Tan's project lays the foundation for achieving his career goals: to translate advances in new materials into smaller and smarter systems by developing novel modeling and control methodologies, and to train tomorrow's control engineers with cross-disciplinary perspectives.

The Faculty Early Career Development (CAREER) Award, the National Science Foundation's most prestigious award for new faculty members, recognizes and supports the early career-development activities of teacher-scholars who are most likely to become the academic leaders of the 21st century. Awardees are selected on the basis of creative career development plans that effectively integrate research and education within the context of the mission of their institution. Tan's proposed research aims to fully realize the potential of ionic polymer-metal composites—informally known as artificial muscles—in the manipulation of delicate microscale objects by developing advanced modeling, sensing, and control strategies. Ionic polymer-metal composites are an emerging class of soft and resilient "smart" materials that produce large deflections (bending motions) under low voltages.

Mimicking biological muscles, these materials can potentially be used to perform sophisticated manipulation tasks, such as capturing and transporting single cells in biological studies, and assembling complex micro- and nanostructures in micro/nanomanufacturing. Tan will develop faithful mathematical models that capture the essential physics of ionic polymer-metal composites and yet are convenient for real-time control design. He will also investigate integrated sensing methods for these materials so that the artificial muscles can precisely deliver the desired motion and force. Tan plans to build a biomimetic manipulator—consisting of a three-link arm and a four-finger microhand—with ionic polymer metal composites functioning simultaneously as structures, actuators, and sensors. He will demonstrate his research results through dexterous manipulation of biological cells using this system.

Through collaboration with industry, the developed control and sensing schemes will be applied to a number of artificial muscle–based biomedical applications including implantable micropumps for drug delivery. Integrating with the research program, Tan will establish an interdisciplinary curriculum on "smart" materials and systems, including a senior design program involving industrial partners and a graduate course on "smart" sensors and actuators in micro- and nanosystems. Tan will also work closely with the Diversity Programs Office and the Sloan Engineering Program to involve women and minority students in developing biomimetic microrobots; he will further use these microrobots as appealing hands-on educational kits to inspire the interest of K–12 students in science and engineering. ✪

—Lynn Anderson

Dale Named Associate Director of MSU Office of Bio-based Technologies

Bruce Dale, a university leader in exploring alternatives to fossil fuels, has been named associate director of Michigan State University's new Office of Bio-based Technologies.

Dale, professor of chemical engineering and director of MSU's Biomass Conversion Research Laboratory, is an internationally known expert in research aimed at converting plant biomass—like fast-growing switchgrass, cornstalks, and stems and leaves from agricultural crops—into fuels and chemicals.

The new office's goal is to marshal MSU research and resources in the plant sciences, chemistry, agricultural sciences, and engineering fields to help foster connections with public and private sector initiatives designed to transform Michigan's economy.

"Dr. Dale brings a lot of energy and a wealth of technical expertise to the office," says Steven Pueppke, director of the Office of Bio-based Technologies. "He's already begun to lead a series of campus conversations to coordinate our activities on the bioeconomy and to strengthen linkages with partners in the private sector."

Dale describes his role as providing "technical reality" stemming from his 30 years of work in biomass technology and in bringing such technology to the marketplace from the laboratory.

"I'll be trying to help put together large proposals and working to link plant science researchers and others with engineers to build relationships allowing us to move forward," Dale says.

Dale, who has been at MSU for 10 years, has developed a patented process called ammonia fiber explosion to pretreat the plant materials, which makes the breakdown of cellulose more efficient, thus tackling one of the thornier problems of producing ethanol.

Dale received his doctorate in chemical engineering from Purdue University. He has received 13 U.S. and international patents and has filed eight patent disclosures during the past two years. ✪

—Sue Nichols, University Relations