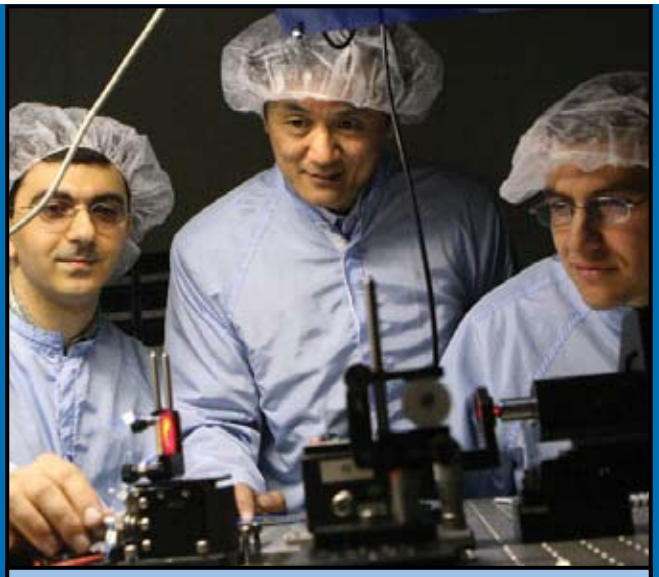
CMC MICROSYSTEMS IMPACT

Crystal Clear: Improving the 'Vision' of Optical Systems with High-Performance Microsystems

Dr. Guchuan Zhu of École Polytechnique de Montréal is designing advanced MEMS-based control systems to improve the adaptive optics systems used in space communications, medicine, military surveillance and large telescopes. His innovative techniques could lead to the adoption of a commercial standard for products that require high-performance MEMS devices.

"Our group is among the few research teams in the world that are working on the design of advanced MEMS-based control systems. It is a field that is becoming increasingly important. This technology has the potential to influence industry standards for optical products in life sciences, aerospace, defence and astronomy—and enable new applications we can not even imagine today."

Dr. Guchuan Zhu
Assistant Professor, Electrical Engineering
École Polytechnique de Montréal



Dr. Guchuan Zhu (centre) works in his lab with Alireza Hajhosseini Mesgar (left), PhD student, and Carlos Agudelo (right), Masters student. His research on MEMS control systems could help high-performance telescopes produce more detailed pictures of the universe.

Dr. Guchuan Zhu, Assistant Professor of Electrical Engineering at École Polytechnique de Montréal wants to help astronomers see distant galaxies, stars and planets more clearly and enable physicians to better diagnose eye diseases and prescribe the right corrective lenses for patients. He hopes to achieve these objectives by making the world's most innovative optical systems even better. The researcher is developing advanced control techniques for the miniature mechanical devices found in giant telescopes and other high-end optical instruments.

This promising microsystem technology could help to eliminate the perceived imperfections that result when peering through an optical device into the atmosphere. For example, a MEMS-based system could automatically stabilize miniature mirrors and actuators—which are among an evolving array of products that require adaptive optics and optic switches—during periods of air turbulence, temperature fluctuation or mechanical stress.

"We're investigating a closed-loop system that can receive feedback and automatically respond to any disturbances in the system," explains Dr. Zhu. "The main limitation with MEMS devices today is that the performance you get today is the only performance you are going to get. It's very limited."

Dr. Zhu has already achieved the first major milestone of the project. Using design software provided by CMC Microsystems, he has developed algorithms to control electrostatic MEMS (such as actuators and micro-mirrors) and successfully modeled the technology concept. His next goal is to incorporate the control function into the MEMS device by using a rapid prototyping platform supplied by CMC. "This creates the opportunity to put our theory into practice by integrating the control systems in a real application," he adds. *cmc*