Carnegie Mellon

MICROELECTROMECHANICAL SYSTEMS LABORATORY

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As information systems increasingly move from the desktop into our pockets and palms, they get closer to the physical world and create new opportunities to perceive and control our machines, structures, and environments. To exploit these opportunities, information systems need to sense and act as well as compute. Providing engineered systems with these new capabilities is the focus of the Microelectromechanical Systems (MEMS) Laboratory at Carnegie Mellon. The MEMS Lab is jointly associated with the Department of Electrical and Computer Engineering, the Robotics Institute, and the Institute for Complex Engineered Systems.

Microelectromechanical systems can be so small that they are not always visible to the human eye. Mechanical components, typically measured in microns (a millionth of a meter), are made with batch-fabrication processes like those used in the integrated circuit industry. Although small, these systems can accomplish many tasks. For example, researchers at the MEMS Lab are creating gas chemical sensors to detect the end of service life of cartridges in gas masks, manipulation systems to store data at a nanometer scale, micromirror arrays to steer laser light, and accelerometers and gyroscopes to sense movement.

MEMS Lab researchers are also working to apply this technology to other fields, such as the communications and biomedical industries. Examples include radio-frequency (RF) MEMS capacitor and resonant filters to help detect usage of the communications spectrum for future cognitive radio applications and an implantable stress sensor chip that is being developed to provide therapeutic feedback while bone heals from fractures.

MEMS Lab researchers are involved in all stages of design, analysis, modeling, fabrication, and characterization of these MEMS devices. They are also developing cost-efficient fabrication approaches to integrate these miniature systems on the same chip with advanced electronics. In addition, they are investigating computer-aided design tools and methodologies that reduce the time from initial concept to final product. This research on microsystems-on-chip technology will lead to its widespread use in future embedded systems from sensor networks to the human body.

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