Sense the Life Sense the World

by Peter Hesketh and Jing Li

Sensor science and technology is growing rapidly in response to an ever-increasing demand for faster, cheaper, smaller, and more sensitive means to monitor the chemical, biological, and physical world around us. Sensors can have a global impact in many areas: environmental cleanup, industrial process control, emissions monitoring, aeronautical and space systems, planetary exploration, nonproliferation of weapons, screening for explosives and contraband, home and workplace safety, and medical diagnosis and care. A sensor provides some of the functionality of analytical instrumentation and the ability for real-time, *in situ* measurement; but with vastly reduced cost, size, and power consumption.

Sensors can have an impact on what they measure; for instance, a room temperature thermometer inserted into a hot cup of liquid cools the liquid while the liquid heats the thermometer. Consequently sensors need to be designed to minimize their effect on what is measured. As the sensor is made smaller, interference effects are diminished and additional advantages are provided. Advances in micro/nano technologies allow a greater number of sensors to be manufactured using Micro/Nanoelectromechancial Systems (MEMS/NEMS) technology. In most cases, a microsensor reaches a significantly higher speed and sensitivity compared with macroscopic approaches. The development of new sensor technology has been very rapid, with new nanomaterials making it possible to tailor the properties of the interface to improve selectivity. The scaling benefits of miniaturization have made, and are continuing to make a dramatic impact on the diversity of available sensors, from use in toys and games, to smart phones that will include chemical sensors in the near future.

The ECS Sensor Division has a diverse range of interests and is a truly interdisciplinary Division. Sensor technology utilizes chemistry, materials science, physics, mechanical engineering, electrical engineering, mathematics, and biology, to advance sensor development for various applications. From a broad range of topics, the three articles that appear in the following pages have been selected to address the specific areas of sensors for energy, sensors for agriculture, and smart sensor systems. These topics are particularly relevant with today's concern for conservation of energy and maintaining the quality of our environment. Gathering information with sensors to improve efficiency and better understand global trends is of paramount importance.

In addition to regular symposia in the areas of sensors and micro/nanosystems technology, topics are related to energy, the environment, medicine, defense, materials, device fabrication, signal processing, and system integration. We invite your participation and welcome suggestions for future symposium topics. We look forward to a continued growth in the field as the application and development of novel transduction platforms, new materials, and nanostructures continue to mature. □

About the Authors

Peter Hesketh is a professor of Mechanical Engineering at Georgia Institute of Technology, and a Member of the Parker H. Petit Institute for Bioengineering and Biosciences. His research interests include nano/microfabrication of chemical and biosensors, in particular microcantilever sensors, microvalves, and novel sensor structures. Hesketh is a Fellow of The Electrochemical Society, the American Society of Mechanical Engineers, and the American Association for the Advancement of Science. He has edited fifteen books on microsystems and sensors and published over 65 journal papers. He may be reached at peter.hesketh@me.gatech.edu.

Jing Li is a senior scientist and a principal investigator at NASA Ames Research Center. Her research interest is in nanotechnology-based chemical sensors and intelligent sensing systems development for various applications in homeland security, medical diagnosis, industrial process, and environmental monitoring. Jing was a Chair of the ECS Sensor Division and a board member of The Electrochemical Society. She has led the team to develop the first nanotechnology-based sensor system flown in space in 2007, and two carbon nanotube-based sensors in the international space station in 2008 for air monitoring of the crew cabin. She has over 40 journal papers and six U.S. patents on chemical sensors and their applications. She may be reached at jing.li-1@nasa.gov.