

## 6.4 Advanced Sensor Technology

### Session Abstract

Organizers: Al Gasiewski, University of Colorado, and Kohei Itoh, Keio University

This session will focus on the state-of-the-art in sensor technology and applications that is expected to enhance our quality of living in the upcoming decades. Topics to be discussed include advanced sensor applications in three areas: global environmental monitoring, urban post-earthquake structural monitoring, and human nerve sensing to enhance the quality of life of handicapped persons.

Sensors for the global environmental monitoring:

During the half-century after the launch of Sputnik humankind has made impressive progress in understanding Earth and environmental processes through new observing systems. Earth-observing satellites have provided global views of weather and the effects of climate change on sea ice, glaciers, corals, and land cover. Through their data the globe has been alerted to the ill effects of many anthropogenic processes, most notably the production of chloroflourocarbons (CFCs), carbon dioxide, and deforestation. Suborbital (rocket-, balloon-, and air-borne) and ground or ship based sensors perform complimentary functions by providing long term and/or intensively-sampled *in situ* data necessary for environmental process studies, climate record development, and satellite calibration and product validation.

Arguably, Earth observation systems have arrived not a moment too soon. As we enter the 21<sup>st</sup> century the role of Earth observation systems in understanding and managing the planet – as well as protecting human life and property from natural disasters – has become essential to maintaining a rising global standard of living. Their importance is underscored by the recent G-8 affirmation of the importance of the Global Earth Observation System of Systems (GEOSS). At the basis of GEOSS are environmental sensors and sensor data systems for the collection, analysis, modeling, and timely distribution of Earth and environmental information. Two representative U.S. components of GEOSS are the future National Polar Orbiting Environmental Satellite System (NPOESS) series of polar-orbiting environmental satellites, and the sensors and data archives of the U.S. Atmospheric Radiation Measurement (ARM) science program. These complimentary components represent the state-of-the-art in global Earth observation.

Sensors for the post-earthquake structural monitoring:

Continuous expansion of Pacific-Rim megacities such as Los Angeles and Tokyo calls for the establishment of sensor systems that facilitate structural monitoring of an entire city after natural disasters such as earthquakes and typhoons. Such sensor systems are important to plan and conduct rescue operations that aim to identify as many trapped people as possible within 72 hours after the disaster, which is the average survival time of a human being without availability of drink. This need is particularly acute when ground transportation and communications systems are not functioning. One of the key activities being developed at the

Earthquake Research Institute of the University of Tokyo in the area of post-earthquake structural monitoring will be presented in the session.

Human nerve sensing:

The internet continues to revolutionize our society in many aspects of everyday life. Among many successful activities, the so-called “Second Life,” which supports virtual life on the internet space is becoming extremely popular. Because of its sophisticated approach to mimicking reality, there is an increasing demand from handicapped and disabled people to participate in Second Life in search of their “first normal life.” In order to meet such demands, a team of engineers at Keio University has developed sensor systems to detect nerve signals that have been intentionally emitted by the disabled person whose physical limitation does not allow use of standard human-computer interfaces such as keyboards, mice, and joysticks. The signals are processed and used to control the behavior of the person within Second Life to let them experience normal life, at least virtually, for the first time.