Guest Editorial
Special Section on VECIMS 2005

VIRTUALITY and measurements interact in at least three cases: 1) when virtualizing techniques are applied to real instruments to create virtual instruments; 2) when measurements provide data for reproducing the real object in virtual reality (VR) worlds; and 3) when the subjects of the measurements are events in virtual environments. These areas are characterized by solid theoretical knowledge of measurement technologies and methodologies and by practical expertise in using up-to-date technologies for remote human–machine interaction. The synergic integration of these aspects leads to advanced measurement systems, adaptive human–computer interfaces, and virtual environments.

The various aforementioned interactions between virtuality and measurements are addressed by the papers selected for this special section to present some research insights in the whole scenario, with specific focus on the topics treated at the 2005 IEEE International Conference on Virtual Environments, Human–Computer Interfaces, and Measurement Systems (VECIMS).

The first area concerns virtual instruments, i.e., the virtualization of the instruments and their interfaces as well as their combination, which creates more complex measurement systems. Applications range from remote instrument observation and control to instrument virtualization directed to shared use and from fusion of heterogeneous multiple sensors to the combination of output devices for measurement quality enhancement. In the paper "3-D Sound Intensity Measurements: Accuracy Enhancements With Virtual Instrument Based Technology," Moschioni *et al.* describe a method for combining three pairs of microphones to create a 3-D sound measurement system with enhanced quality in terms of accuracy and bandwidth.

VR environments provide users with a natural and easy-to-understand modality for interfacing with an application. In fact, VR interfaces mimic the relevant aspects of the normal sensory reality experienced by the users, thus increasing the effectiveness of the related applications. Since the stimulus generated in VR environments is completely controllable and the user actions can be logged and measured, VR provides an excellent framework for a wide range of applications in which human–computer interactions are critical for the effectiveness and the efficiency of the applications themselves. Relevant examples are platforms for experiments on perception, tools for rehabilitation activities, and training environments. In "Suitability of Searching and Representing Multimedia Learning Resources in a 3-D Virtual Gaming Environment," El Saddik *et al.* propose a VR environment directed toward supporting a vivid presentation of information search results. The usability of the proposed application environment is evaluated by taking into account the computational resources and the familiarity with 3-D gaming environments.

Although VR applications are commonly based on visual and audio stimulations, haptic devices have become prevalent in research and on the market by adding—through the sense of touch—more realism to the virtual environments and by enriching the interfaces with force feedback. Haptic devices have been increasingly used whenever it has been critical to accurately capture the dynamics of movements, such as in surgical training, telemedicine, or rehabilitation. They are also valuable whenever the sense of touch enhances realism or improves the effectiveness of the application, such as in games or computer-aided design applications. Since haptic devices are less common and are more diversified than video/audio devices, the design of haptic-based applications usually considers only one particular haptic device. This restricts the system functionalities to those supported by the considered device and makes it difficult to achieve some system portability and code reuse. In "AdHapticA: Adaptive Haptic Application Framework," Orozco *et al.* propose a framework that aims to mitigate the efforts for developing haptic-based applications by adaptively interfacing an application with different haptic devices.

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