Guest Editorial

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Riko Šafarič, Aleš Hace
University of Maribor, Slovenia

This special focus special issue of the IJOE journal reports the current research work in three topics: Mobile telerobotic systems, Robotics e-learning and Bilateral teleoperation with focus on practical solutions.

The first topic - Mobile telerobotic systems for tele-exploration are gaining more and more importance, especially for industrial inspection tasks and rescue operations. In scenarios, like in urban search and rescue, fully autonomous systems are not applicable because of safety or efficiency reasons, so telerobotic or remote controlled mobile robots are needed. This topic is presented by the excellent paper of the authors: Hartmut Surmann, Dirk Holz, Sebastian Blumenthal, Thorsten Linder, Peter Molitor and Viatcheslav Tretyakov with the title: "Teleoperated Visual Inspection and Surveillance with Unmanned Ground and Aerial Vehicles". The paper introduces the robotic system named Unmanned ground-air vehicle consisting of two semi-autonomous robot platforms, Unmanned ground vehicle (UGV) and Unmanned aerial vehicle (UAV). It presents three topics of the inspection with the combined UGV and UAV:

- teleoperated control by means of cell or smart phones with a new concept of automatic configuration of the smart phone,
- the camera and vision system with the focus to real time feature extraction, and
- the architecture and hardware of the UAV.

The second topic – Robotics e-learning, deals with Virtual and remote laboratories for learning and training robotics in the academic community, which allows students to acquire methods, skills and experience related to real equipment in an intuitive and cost-effective way. The purpose of the presented paper of authors C. A. Jara, F. A. Candelas and F. Torres with the title: "An advanced interactive interface for robotics e-learning", is to present the development and the implementation of an e-learning environment in the field of Robotics. The main application goal of this approach is to allow students to simulate and to teleoperate a robot arm in an easy and user-friendly way.

The third topics – Bilateral teleoperation is the paradigm of force feedback robotic systems, which is extremely important in both telerobotics (when the remote robotic system is to come in the contact with the environment or in telemanipulation) and haptic systems. These systems are concerned by providing kinesthetic (and in extension also tactile) sense from physically or virtual remote place. Bilateral control of master-slave robotic architecture is to be realized in order to provide not only kinematic matching of the robots but also proper transparency of a teleoperator. Higher is transparency better is transmission of the kinesthetic sense. Though transparency of a teleoperator is a key performance index, stability must still be put on the first place while designing robot control. Furthermore, robustness of implemented feedback control is also an important issue. The papers of A. Hace: "Bilateral Teleoperation by SMC Design Approach" and J. Velagić et al. "The Improvement of Telerobotic System Behavior in Contact with Remote Environment by Extension of an Impedance Controller" cope with the problems that appear in the design of bilateral master-slave robotic teleoperation. The first paper provides introduction into bilateral control and gives an overview of different basic bilateral architectures showing that transparency and robust stability are obviously conflicting design goals. The rest of the paper deals with robust issues of transparency optimized bilateral robotic control related to the highly nonlinear nature of multi

degrees-of-freedom robotic mechanism. It introduces sliding mode control design approach to apply robust impedance control principle for master and slave robots within the teleoperator system, respectively. The second paper extends the problem of force reflecting teleoperation to the time delay that appears in transmission of the signals between master and slave robots within the communication system. The communication delay not only that seriously impairs the teleoperator performance but can significantly jeopardizes stability of the system. The paper shows that the problem can be coped by introduction of wave variables into the communication and by design of symmetric impedance matched master-slave robotic system. Communicating wave variables instead of power variables passives the transmission system, however due to wave reflections, which can cause unwanted oscillations within the system, additional wave filter of first order is applied in the feedback communication line.

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