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EDITORIAL

Editorial: special issue on space robotics

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Outer space is a harsh environment, with extreme temperatures, vacuum, and intense cosmic radiation. The additional challenges of maneuvering in micro gravity as well as the requisite travel and communication across great distances make human access to space very difficult and limited. Thus, the application of intelligent robotics technology for outer space exploration is considered an important field. Robotics technology covers a large area of potential applications, from manipulation in the Earth's orbit to locomotion on remote planets and from fully autonomous systems to human-in-the-loop systems for crew assistance.

This special issue of the Springer Journal of Intelligent Service Robotics on Space Robotics seeks to present the latest developments in this exciting field of robotics research, in particular, addressing the issues of mathematical models for unique physics in both space free-floating robots and surface mobile robots, effective architectures for human crew assistance in complex mission scenarios, and specific implementation in hardware and software systems for ground-based verification.

This special issue contains four peer-reviewed papers covering the exciting activities in the field of robotics applied in the orbital and planetary environments. In Nanos and Papadopoulos, mathematical models are investigated for a unique manipulator control on the use of free-floating space robots, where the presence of angular momentum influences on the behavior of the systems in orbital microgravity environment. In Ding, Deng, Gao, Nagatani and Yoshida, a thorough review with 135 reference articles is conducted for state of the art research on the wheel-soil interaction mechanics for surface mobile robots such as planetary rovers. Here the key issue is "terramechanics," which is compounded from the words "terrain" and "mechanics." It has been studied since 1960s, but additional major contributions have been made by the space robotics community in recent years. Zereik, Sorbara, Merlo, Simetti, Casalino and Didot report their recent development of a planetary exploration supporting system in Eurobot Ground Prototype (EGP) project. The system can execute a number of operations both in a completely autonomous manner and in a strict cooperation with the astronauts. A coordination architecture was developed and implemented with vision and force feedback controllers. Cordes, Ahrns, Bartsch, Birnschein, Dettmann, Estable, Haase, Hilljegerdes, Koebel, Planthaber, Roehr, Scheper, Kirchner report their recent development of LUNARES project that provides a terrestrial demonstrator to evaluate the feasibility of a heterogeneous robotic team for lunar crater exploration. The paper reviews the achievements and lessons learned during the project.

The guest editor would like to thank the authors, reviewers and the editorial team for their contributions and services to the special issue. I would also like to thank the Editor-in-Chief, Professor Yuh, for his support and advice in the review and editorial process. I hope that the special issue will serve as a good reference in capturing the state-of-the arts in space robotics today.

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