

Special Issue

Intelligent Actuation and Control in Rehabilitation Robotic Systems

Message from the Guest Editor

Rehabilitation robotics has undergone a transformative shift over the past decade, driven by the convergence of advanced actuation technologies and intelligent control paradigms. The next frontier lies in achieving a seamless symbiosis between humans and rehabilitation robotic systems.

This Special Issue aims to present and disseminate the most recent advances in intelligent actuation and control for rehabilitation robotic systems. We invite contributions that address the full spectrum of challenges at the human–robot interface, from novel actuator architectures and compliant mechanism design to AI-driven control, motor intent decoding, and co-adaptive learning frameworks. Topics of interest include, but are not limited to, the following:

- Design and control of compliant and quasi-direct-drive actuators for rehabilitation robotics;
- AI-driven motor intent recognition and co-adaptive control using multimodal biosignals;
- Exoskeleton and orthosis development for upper and lower limb rehabilitation;
- Musculoskeletal simulation and digital twin frameworks for rehabilitation device validation.

Guest Editor

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About the Journal

Message from the Editor-in-Chief

We are just entering the Next Wave of Technology (NWT) where actuators will play the same role as the computer chip did for computers/social media approximately four decades ago. Just in the U.S., production of \$1 trillion year of electromechanical systems (vehicles, orthotics, manufacturing cells, freight trains, aircraft, etc.) will be impacted by the NWT, all driven by actuators. Five key trends can be found for the future perspectives: “Performance to Reliability”, “Hard to Soft”, “Macro to Nano”, “Homo to Hetero” and “Single to Multi functional”. We invite papers that primarily impact these economic sectors; those illustrating basic scientific principles are also welcome.

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