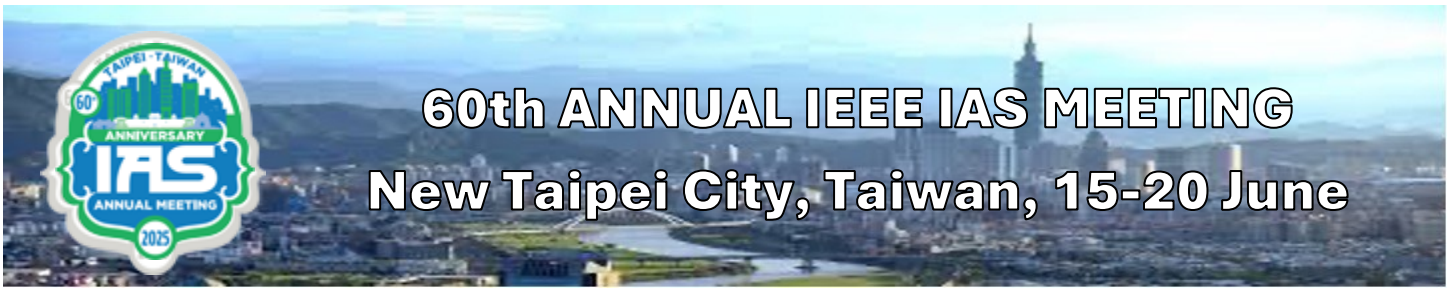

Special Session on

Advanced Power Conversion Technologies in Robotics

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Technical Outline of the Session and Topics:

As robotic systems expand from structured industrial scenarios to open dynamic environments (medical, rescue, human-machine collaboration), their performance boundaries are being redefined, like humanoid robotics need to achieve the explosive force of humanoid joints (>500 Nm instantaneous torque) and high-frequency dynamic balance (such as the flip action of Boston Dynamics Atlas). However, current robotic research generally tends to "focus on algorithms and neglect hardware", but the improvement of robotic system performance must be based on the underlying power conversion technologies. Power electronics, electric machines, and drive technologies, as the "power heart" of robotics, directly determine the above performance limits. This special session will highlight innovations in electric machines, motor drives, power converters, and energy management architectures that improve robotic capabilities across industrial, medical, rescue, and human-assistive applications. Discussions will focus on emerging solutions to achieve ultra-high-power density, dynamic responsiveness, and intelligent energy utilization, ultimately pushing the boundaries of robotic performance in speed, efficiency, and operational longevity.

The scope of this Special Session includes but is not limited to the topics below:

- Advanced motor drive topologies for robotic joints
- Power electronic technologies for robotic power sources
- Dynamic torque control algorithms for humanoid and collaborative robotics
- Integrated design of motors, drives, and thermal management in compact robots
- Fault-tolerant power conversion for safety-critical robotics
- EMI/EMC mitigation in high-frequency robotic drives
- AI-optimized energy distribution in multi-actuator systems

Submission of papers: deadline follows the deadline for the regular papers. All the instructions for paper submission are included in the conference website: https://ias-am.ieee.org/2025/