Special Issue Reprint

Robotics and Parallel Kinematic Machines

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Edited by
Swaminath Venkateswaran
Jong-Hyeon Park
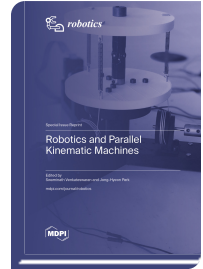
Parallel kinematic machines (PKMs) are widely recognized for their higher stiffness, high payload-to-weight ratio, and superior precision compared to serial robots. Their applications span high-speed machining, medical robotics, and space. Despite these advantages, PKMs face inherent challenges in design and control due to complex kinematics, limited workspaces, and intricate singularity conditions. Recent research and industrial developments have focused on improved modeling techniques, analysis of singular configurations, and reconfigurable architectures. Considerable attention has been given to workspace optimization, singularity avoidance, robust design procedures, and the integration of compliant components to meet evolving application demands. Still, several theoretical and practical aspects remain underexplored, including cuspidal configurations—where a robot can shift between multiple inverse kinematic solutions without singularities—and self-motion conditions, in which the end-effector moves even with locked actuators.

Emerging topics such as modular PKM architectures, dynamic performance evaluation, and control-aware design optimization are also attracting attention, particularly for high-precision applications under uncertain or varying load conditions.

This Special Issue brings together eight articles addressing PKMs and their potential applications to meet growing industrial demands, providing researchers and industry experts with deeper insights into PKM analysis and architecture-based applications.

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