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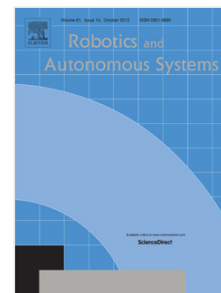
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Proxy-based Position Control of Manipulators with Passive Compliant Actuators: Stability Analysis and Experiments

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Abstract

In this work we introduce a position control scheme which is targeted at the enhancement of the safety of compliant joint robots. In addition to the necessity for accuracy and robustness that both serve as prerequisites for the successful performance of these tasks, the ability to safely handle unexpected events, such as communication failures or unintended interactions which may endanger the robot/human safety, is a paramount requirement. To achieve a smooth motion behaviour of compliant systems under these circumstances, damping control actions are essential. To this end, a novel proxy-based approach for compliant joint robots, integrated into a passivity-guaranteed controller, is proposed. The stability analysis of the proposed scheme is presented and the global asymptotic convergence, as well as the passivity of the control scheme, is analytically proven. The performance of the proposed approach is practically evaluated by means of experiments on a spatial robotic arm with passive compliant actuators, and is compared with that of a classical PD approach. Experimental results validate the ability of the proposed approach to inject damping in order to provide smooth and damped recovery when an interruption in task execution occurs.

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