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Paper title	Noncollocated Proprioceptive Sensing for Lightweight Flexible Robotic Manipulators
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Abstract	<p>This article presents the design of a noncollocated feedback system for flexible serial manipulators. The device is a passive serial chain of encoders and lightweight links, mounted in parallel with the manipulator. This measuring arm effectively decouples the manipulator's proprioception from its actuators by providing information on the actual end effector pose, accounting for both joint and link flexibility. The kinematic redundancy of the measuring chain allows for safe operation in the context of human–robot interaction. A simple yet effective error model is introduced to assess the suitability of the proposed sensor system in the context of robotic control. The practicality of the device is first demonstrated by building a physical joint-encoder assembly and a simplified planar measuring arm prototype. With this additional feedback, a task-space position controller is devised and tested in simulation. Finally, the simulation results are validated with an experimental 3-DoF lightweight manipulator prototype equipped with a five-joint measuring arm.</p>
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