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Design, Prototyping and Control of Low-Impedance Hybrid Robots for Intuitive Physical Human-Robot Interaction

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Abstract

Over the past decades, parallel mechanisms have found applications in many areas including motion simulation, high-speed robots, machine-tools and cable-driven systems, to name a few. More recently, parallel and hybrid robots have been proposed in the emerging field of physical human-robot interaction (pHRI) which aims at taking advantage of the complementary capabilities of robots and humans. One of the key challenges in pHRI is to provide an intuitive physical interaction to the human user. Due to their low moving inertia, parallel robots can be used advantageously to design low-impedance mechanical interfaces in order to increase the mechanical bandwidth of the human-robot interaction, thereby leading to a very intuitive behaviour. In this presentation, the use of parallel and hybrid robots in the design of pHRI devices is proposed and examples of prototypes developed at Laval University are shown. The use of kinematic redundancy in order to increase the rotational workspace is also discussed. The results clearly demonstrate the capability of parallel mechanisms to provide high interaction bandwidth for pHRI robots.