Compliant Limb Sensing and Control for Safe Human–Robot Interactions

Colin Miyata, Mojtaba Ahmadi

Abstract— The current paper proposes a control methodology for ensuring safety during human–robot interaction based on a compliant sensor covering the robot links as a lightweight shell. The method can be used with existing robots without the need for mechanical redesign. To assess the behaviour of the proposed control law, the controller is analysed using a linear robot model. Stability analysis is performed and requirements on the controller parameters are derived. The effect of the controller parameters on the perceived impedance and the maximum safe operating velocity of the robot are determined via the linear model. The adverse impact of dry friction is analysed in simulation and methods are developed to mitigate the effects. The controller is implemented on a 1 DoF robotic joint and the results are compared to those of a traditional admittance control law, demonstrating comparable transient response while maintaining a simple control structure and decreased risk of instability.

About the author— Colin Miyata is a current PhD candidate in the department of mechanical and aerospace engineering. His PhD research is an extension of his Master's research focusing on ensuring robot safety for industrial manipulators through the use compliant tactile sensors. The presented work was completed during his Master's and was recently accepted for presentation at the IEEE international conference on robotics and automation (ICRA) in Montreal.