Abstract

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Disturbance Attenuation of a Handheld Parallel Robot

Experimental results for a handheld six degrees of freedom parallel robot with realtime position control and disturbance attenuation are presented. The robot’s base is freely movable in space by a human operator, while the tool is position controlled and stabilized relatively to a reference coordinate system. The challenge is to decouple the tool as far as possible from the user involved arm tremor and unintended motions. The robot is equipped with a camera-based position and orientation tracking system, linear actuators, and a realtime control system. Kinematics, co-ordinate transforms and workspace limits are presented with its specifications. Experiments with sinusoidal stimuli on a test stand and during the handheld operation are discussed with respect of stabilizing performance and work-space violation. The resulting error bounds of less than 0.5 mm in the Cartesian position demonstrate that such a robot device has the potential to improve the classical manual surgical interventions. Further, the paper demonstrates the compliance of the user motion to the workspace provided by the robot.