

Time-Optimal Control of Hydraulic Manipulators

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Many hydraulic manipulators work in unstructured surroundings, and perform non-repetitive tasks. These may involve transporting unknown loads along paths in space, which are decided online by the operator. This paper addresses the problem of optimizing such motions for speed, under given actuator capacities and bounds on payload uncertainty. An arbitrary reference trajectory is input, as an untimed sequence of desired manipulator's configurations. The timing of the actual trajectory is then chosen such, that it fully utilizes the capacity of actuators, under the most disadvantageous loading conditions. This is done by extending in time sections of the trajectory, where actuator capacities are exceeded, and shrinking those sections, where actuator capacities are not yet met. The resultant control law tracks the reference trajectory, to within a certain threshold of accuracy, with almost highest possible speed. The paper is illustrated by simulation results of a three-link hydraulic arm, tracking several reference paths.

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