Brief Comparison of Manipulator Controllers

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Four controllers were implemented on a simulated two-link RR manipulator. Each controller used the following PID controller:

where

The four controllers tested were the PID with Gravity Cancellation evaluated at , PID with Gravity Cancellation evaluated at , Computer Torque (Inverse Dynamics), and the Feedback Linearizing Controller. The following graphs show the step response of each controller to the command



Figure 1. Error plot of PID with GC evaluated at reference angle



Figure 2. Error plot of PID with GC evaluated at steady state angle



Figure 3. Error plot of Computer Torque Controller



Figure . Error plot of Feedback Linearizing Controller

The Feedback Linearizing Controller outperforms all other controllers in terms of both rise time and settle time. Its rise time is approximately half of the next best controller, and about ¼ the settle time. It also outperforms the other controllers when simulating ramp and cosine signals.

The Computed Torque Controller response is equivalent to the the PID with Gravity Cancellation at due the reference signal having zero velocity. When tracking a ramp signal, the Computed Torque Controller outperforms the Gravity Cancellation Controllers.