

Using Optimal Control Method to Investigate the Stability and Transparency of a Nonlinear Teleoperation System with Time Varying Delay

Authors : Abasali Amini, Alireza Mirbagheri, Amir Hodayoun Jafari

Abstract : In this paper, a new structure for teleoperation systems with time varying delay has been modeled and proposed. A random time varying the delay of up to 150 msec is simulated in teleoperation channel of both masters to slave and vice versa. The system stability and transparency have been investigated, comparing the result of a PID controller and an optimal controller on each master and slave sub-systems separately. The controllers have been designed in slave subsystem for reducing position errors between master and slave, and another controller has been designed in the master subsystem to establish stability, transparency and force tracking. Results have been compared together. The results showed PID controller is appropriate in position tracking, but force response oscillates in contact with the environment. We showed the optimal control established position tracking properly. Also, force tracking is achieved in this controller appropriately.

Keywords : optimal control, time varying delay, teleoperation systems, stability and transparency

Conference Title : ICOCASP 2017 : International Conference on Optimal Control Applications and Semidefinite Programming

Conference Location : Paris, France

Conference Dates : August 28-29, 2017