

FEASIBILITY TEST RESULTS OF BILATERAL TELEOPERATION USING THE ENERGY-BOUNDING ALGORITHM

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Abstract: Time delays in communication channels usually make teleoperation systems unstable. To cope with this, we apply the energy-bounding algorithm (EBA) that had been proposed for stable haptic interaction. The EBA restricts the energy generated by the sample and hold operator to consumable energy by the energy-consuming physical damping in the haptic system and some part of human arm to guarantee the passivity condition of whole system. This algorithm always guarantees stable haptic interactions, but compromises the displayable impedance range of the virtual environment.

The EBA can be straightforwardly applied for bilateral teleoperation due to the analogy between the haptic simulation system and the teleoperation system. The video shows some feasibility test results of the EBA for bilateral teleoperation. Various test results for free, contact, and abrupt motions show that the EBA can ensure stable bilateral teleoperation for the fairly large amount of constant/variable time delays (2.5 sec (one-way) for free motion and 300 msec (one-way) for contact motion).

Keywords: Bilateral Teleoperation, Time delay, Energy-bounding algorithm

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