

RESEARCH TOPIC: Control of a Flexible Bracing Manipulator

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SHORT TERM OBJECTIVE: Integration of current research work to realize the
bracing manipulator

The tip position control of a flexible manipulator can be considered as the most general and complicated problem in the control of robotic manipulators, because it is the tracking control of the nonlinear, noncolocated, nonminimum-phase system with uncertainty. All research results about the flexible manipulator control were integrated to show a control scenario of a bracing manipulator. First, dynamic analysis of a flexible manipulator has been done for modeling. Especially, the nonminimum-phase system characteristics have been studied in detail, and the relation between the nonminimum-phase system, and causal and anticausal systems has been analyzed. Second, from the dynamic model, the inverse dynamic equation is derived, and the time-domain inverse dynamic method were proposed for the calculation of the feedforward torque and the desired flexible coordinate trajectories. Third, a tracking controller is designed by combining the inverse dynamic feedforward control with the joint feedback control. The control scheme has been applied to the tip position control of a single-link flexible manipulator for zero and non-zero initial condition cases. Finally, the contact control scheme was added to the position tracking control. Therefore, a control scenario of a bracing manipulator is provided, and evaluated through simulation and experiment on a single-link flexible manipulator.

PUBLICATIONS

1. Book, W.J. and Kwon, D.S., "Contact Control for Advanced Applications of Light Weight Arms", presented at the Symposium on Control of Robots and Manufacturing, Automation and Robotics Research Institute, University of Texas at Arlington, Texas, November, 1990.
2. Kwon, D.S., "An Inverse Dynamic Tracking Control for Bracing a Flexible Manipulator", Ph.D. Thesis, George W. Woodruff School of Mechanical Engineering, Georgia Institute of Technology, to be published in June, 1991.
3. Kwon, D.S., and Book, W.J., "Tracking Control of Nonminimum-Phase Flexible Manipulator", submitted to the 1991 ASME Winter Annual Meeting.