主　論　文　要　旨

論文題名

Study on Feedback Trajectory Tracking Control of robot Arms under the Geometric Endpoint Constraints

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主論文要旨

As one of the force control methods of a robot manipulator, hybrid position/force control is shown as a general method. Hybrid position/force control creates an input so that the directions of position and force may be divided and it may not interfere mutually. Furthermore, since the dynamics of a robot is nonlinear, it makes a control law so that each input/output of a position and the force may become linearity by nonlinear compensation. In practice, however, the parameter values of geometrical equations, kinematic and dynamics of the robot contain estimation errors. For this reason, although it is dependent on the feedback control in which the error of position and force has coupled in practice, the performance of the feedback control is not necessarily clear.

This thesis describes position/force trajectory tracking feedback control performance of robot manipulators under parameter estimation error. It is mathematically proven that the trajectory tracking performance can be improved by setting suitable combination of the feedback gains even though all parameters contain estimation errors.

Coulomb friction force of the motion direction decided by the constraint force is disregarded in many cases. Considering the Coulomb friction in a contact surface, the constraint force itself appears in a movement direction. Since constraint force is coupled with a movement direction, the analyses of motion of the robot are made difficult. This thesis analyzes the details of Coulomb friction effect in the motion direction and point out that there is another singular point with Coulomb friction when a robot contacts a surface of an object. The characteristics of Coulomb friction singular points are revealed by both of theoretical and numerical approaches. From the results, it is shown that contact forces dramatically increase as the robot closes Coulomb friction singular points. The effectiveness of Coulomb friction singular points is demonstrated by some simulation results.