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TRACKING CONTROL OF A TWO-LINK PLANAR MANIPULATOR USING NONLINEAR MODEL PREDICTIVE CONTROL

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Abstract. *Model predictive control (MPC) is an optimization-based approach and decides a control input for the system output to track a reference trajectory using an optimal computation. The reference trajectory is an ideal trajectory for the system output to converge on a desired value. In this paper, a tracking controller for a two-link planar manipulator on the horizontal space via nonlinear model predictive control (NMPC) is proposed. In order to guarantee a desired tracking performance, a time-variable and time-coefficient of the reference trajectory is used in the proposed controller instead of using a time-constant. The time-coefficient is tuned based on a control error between a controlled variable and a desired value. In order to show the effectiveness of the proposed NMPC controller, numerical simulations comparing the proposed method with the previous method are performed.*

Keywords: Nonlinear model predictive control, Tracking control, Two-link planar manipulator, Nonlinear control

1. **Introduction.** Model predictive control (MPC) decides a control input by an optimal computation as the system output tracks a reference trajectory which is an ideal trajectory in order for the system output to converge on the desired value [1]. In general, a reference trajectory is designed to reduce a control error between a controlled value and a desired value exponentially with time.

MPC is widely adopted in industry because this method solves an optimal control problem with some constrains, especially, it has been popular in process control where system dynamic is moving slow [2, 3]. MPC has been already extended to nonlinear systems (NMPC) and many NMPC controllers have been proposed [4, 5, 6]. However, applications to tracking control of servo systems having a first time-constant are still a few. Therefore, in this paper, a new NMPC for tracking controller of a nonlinear two-link planar manipulator having two actuators (shown in FIGURE 1) is proposed. This controller uses a newly defined reference trajectory. The new trajectory has a time-variant and time-coefficient instead of the time-constant to adapt the fast moving manipulator. Proposed time-coefficient is tuned based on the control error between the controlled value