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TWO-DEGREE-OF-FREEDOM PID CONTROLLER BASED ON EXTENDED GENERALIZED MINIMUM VARIANCE CONTROL

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Abstract. *The present paper discusses the design methods for Generalized Minimum Variance Control (GMVC)-based PID controllers in a two-degree-of-freedom (2DOF) system. The PID parameters of the PID controllers are designed on the basis of GMVC, and they are designed as self-tuning controllers. In the present paper, PID parameters are decided such that a GMVC law is approximated by a PID controller. Therefore, in design of a 2DOF PID controller based on GMVC with a feed-forward compensator (abbreviated as FF-type GMVC), because the order of the feed-forward compensator depends on a dead-time, the approximation deteriorates if the dead-time is long. In the present paper, GMVC with a pre-compensator (PC-type GMVC) is approximated by a 2DOF PID controller to obtain better approximation. Furthermore, a 2DOF PID controller having time-varying proportional gain is based on a strongly stable GMVC with a pre-compensator to improve control performance. Numerical examples are given to confirm the effectiveness of the proposed method.*

Keywords: PID Control, Generalized minimum variance control, Two-degree-of-freedom, Strongly stable, Time-varying proportional gain, Coprime factorization

1. **Introduction.** Proportional-Integral-Derivative (PID) control has been most widely employed because of its simple structure and the intuitive understandability of controller parameters. Numerous advanced control techniques have been proposed, and their potential ability is higher than conventional PID control. However, the most advanced control could not be employed in industries. This is because PID control has the advantages as stated above, but advanced control is more complex than PID control. Hence, we propose that advanced control be introduced into industries by upgrading PID control. Therefore, the present paper discusses a way to realize the performance of advanced control by PID control. To this end, PID parameters of a PID controller are designed on the basis of Generalized Minimum Variance Control (GMVC) [1, 10]. In design of GMVC, a cost function in which control error and control input are evaluated using weighting factors is minimized, and a control law is derived. Design methods for a GMVC-based