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AN EXTENSION OF TWO DEGREE-OF-FREEDOM OF GENERALIZED PREDICTIVE CONTROL FOR M-INPUT M-OUTPUT SYSTEMS BASED ON STATE SPACE APPROACH

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Abstract. *This paper proposes an extension method of two degree-of-freedom generalized predictive control (GPC) for m-input m-output systems by using coprime factorization approach. The extended controller has a new design parameter which can change controller poles without changing closed-loop poles. And the proposed method reveals an effect of integral compensation only if there exists modeling error and/or disturbance. Therefore, performance degradation due to integral compensation, such as a slow response or an excessive control effort, can be avoided when the controlled system has no perturbation.*

Keywords: Generalized predictive control, Two degree-of-freedom, Coprime factorization approach

1. **Introduction.** Generalized Predictive Control (GPC) [1, 2] has been first proposed by Clarke and others in 1987. The controller has a feature that performance index includes parameters of prediction horizon and control horizon and weighting factor. These parameters are an interval of predicting a behavior of future output based on a nominal model, an interval of calculating optimal future inputs and a parameter on control input respectively. The control signals are derived by minimizing a performance index on future control inputs and re-calculated receding from their horizons at each sampling time. With these features, the control strategy has been accepted by many practical engineers and applied widely in industry. In this paper, two degree-of-freedom system means the characteristics of output response and disturbance response can be designed independently. That is, on one hand the characteristic of output response is designed by minimizing a performance index. On the other hand the characteristic of disturbance response is designed by a gain of integral compensator.

Many papers have proposed two degree-of-freedom optimal servo systems [3, 4] and authors have proposed two degree-of-freedom of generalized predictive control based on state space approach [5, 6, 7]. On the other hand, two degree-of-freedom of GPC for multi-input multi-output systems has not been extended by using coprime factorization