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AN EXTENSION OF SELF-TUNING TWO DEGREE-OF-FREEDOM GPC BASED ON POLYNOMIAL APPROACH WITH COMPUTATIONAL SAVINGS

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Abstract. *This paper extends a self-tuning two degree-of-freedom generalized predictive control(GPC) by using Youla-Kucera parametrization and saves the amount of computation to calculate the controller by reducing the number of solving Diophantine equation. The proposed method reveals the effect of the integral compensation only if there is modeling error or disturbance in the case that the identified plant parameters converge on true values. And it aims for easier application of the self-tuning GPC to practical systems by computational savings.*
Keywords: Generalized predictive control, Self-tuning control, Computational savings

1. **Introduction.** Generalized Predictive Control (GPC) has been proposed by Clarke and others in 1987 [1, 2]. The control law can be derived by a minimization of performance index including design parameters, which are called as prediction horizon, control horizon and weighting factor of control input. The control input is re-calculated at each sampling step, and the controlled output can track to a step-type reference signal robustly because GPC [1, 2] includes an integral compensation. Therefore it has been accepted by many practical engineers and there are many papers related with GPC for applying controllers to practical systems [3, 4, 5]

Whereas, if the controlled plant is modeled accurately and there is no disturbance, the controlled output can track to a step-type reference signal without an integral compensation. And the effect of integral compensation has a possibility of a change for the worse of transient response or an increase of control input. For safety, it is desirable that its effect appears only if there is modeling error or disturbance. In this paper, this feature is defined as two degree-of-freedom system because the characteristics of the output response and the disturbance response can be designed independently. That is, on one hand the characteristic of the output response is designed by minimizing the performance index, on the other hand the characteristic of the disturbance response is designed by the gain of the integral compensation. Although many papers have proposed two degree-of-freedom optimal servo systems [6, 7] and the authors have proposed two degree-of-freedom GPC based on state space approach and polynomial approach [8, 9, 10, 11].

Moreover the authors have extended two degree-of-freedom GPC based on polynomial approach [12]. The extended method has a new design parameter and can change the