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# DESIGN OF ROBUST OPTIMAL EIGENVALUE-ASSIGNABLE OUTPUT FEEDBACK PID CONTROLLERS FOR LINEAR UNCERTAIN MULTIVARIABLE SYSTEMS VIA ORTHOGONAL-FUNCTIONS APPROACH AND GENETIC ALGORITHM

Wen-Hsien Ho[1], Shinn-Horng Chen[2], Jyh-Horng Chou[3] and Tung-Chia Wang[2]

[1]Department of Medical Information Management
Kaohsiung Medical University
100 Shin-Chuan 1st Road, Kaohsiung 807, Taiwan
whho@kmu.edu.tw

[2]Department of Mechanical Engineering
National Kaohsiung University of Applied Sciences
415 Chien-Kung Road, Kaohsiung 807, Taiwan
shchen@cc.kuas.edu.tw

[3]Institute of System Information and Control
National Kaohsiung First University of Science and Technology
1 University Road, Yenchao, Kaohsiung 824, Taiwan
choujh@ccms.nkfust.edu.tw

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Abstract. *By complementarily fusing of the robust regional eigenvalue-assignability condition, the orthogonal-functions approach (OFA) and the hybrid Taguchi-genetic algorithm (HTGA), an integrative method is proposed in this paper to design the robust optimal eigenvalue-assignable output feedback PID (proportional-integral-derivative) controller such that (i) the eigenvalues of a linear closed-loop uncertain multivariable system can be retained inside the same specified region as the nominal closed-loop system does, and (ii) a quadratic finite-horizon integral performance index for the linear nominal multivariable control system can be minimized. In this paper, the robust optimal eigenvalue-assignable output feedback PID control problem of a linear uncertain multivariable control system is converted to the robust optimal eigenvalue-assignable static output feedback control problem of a linear uncertain singular system. A design example of the robust optimal eigenvalue-assignable output feedback PID controller for an uncertain stirred tank system is given to demonstrate the applicability of the proposed integrative approach.*
**Keywords:** Optimal control, Eigenvalue assignability, Multivariable PID control systems, Singular systems, Parameter uncertainties, Orthogonal-functions approach, Genetic algorithm

1. **Introduction.** The PID (proportional-integral-derivative) controller is the most common form of feedback in use today, and is successfully used for a wide range of application: process control, motor drives, magnetic and optic memories, automotive, flight control, instrumentation and so on [1-4]. But the problem for the performance design of linear multivariable PID control systems is still a real challenge to control system engineers [5]. Therefore, recently, some researchers have proposed some approaches to study the performance design problems of linear multivariable PID control systems (see, for example, [5-15] and references therein).