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OPERATOR BASED ROBUST STABILITY AND TRACKING PERFORMANCE OF MIMO NONLINEAR SYSTEMS

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Abstract. *In this paper, robust stability and output tracking performance of multi-input multi-output (MIMO) nonlinear feedback system are considered by using operator based robust right coprime factorization approach. Sufficient conditions for the MIMO nonlinear system to be robustly stable are derived, and tracking filters are designed to realize the desired tracking performance. Finally, a simulation example is given to support the theoretical analysis.*

Keywords: Robust right coprime factorization, MIMO nonlinear systems, Robust stability, Output tracking performance

1. **Introduction.** The robust stability and output tracking problem of nonlinear control systems are important issues in practice. Many researchers have discussed these issues by using various kinds of methods, for example, sliding mode control, fuzzy control, neural network control and so on [10, 12, 13]. However, for using those methods, the state-space equation of the controlled system should be given, and in many cases, approximation should be used to obtain the model from the real system. In order to avoid that, and also for the purpose of real application, operator based robust right coprime factorization approach is an effective method, which has attracted much attention due to its usefulness in the control field [1-9,12]. It uses the model given by basic physics rules from the real system. Namely, approximation of the real system is avoided. Moreover, robust stability can be guaranteed by using a Bezout identity. As a result, the proposed approach is relative simple, and some real application on SISO system using the above approach have been given in [4-6]. A brief summary on the relevant studies is presented below to lay a foundation for the paper.

The concept of coprime factorization has been introduced into nonlinear feedback control systems since 1980s [1, 8, 9, 11]. Robust right coprime factorization and robust stability of nonlinear plant under perturbation were studied in [2]. A new condition of robust right coprime factorization of nonlinear systems with unknown bounded perturbations was derived and the output tracking problem with different spaces of reference input and output was discussed in [7]. Recently, by using robust right coprime factorization approach, a fault detection method in an uncertain aluminum plate thermal process control system with input constraints was presented in [5]. In [3], networked nonlinear control for an aluminum plate thermal process with time-delays was designed. A flexible arm experimental system with uncertainties was considered in [4] and thermal control of an aluminum plate with a peltier device was studied in [6].

However, robust nonlinear control for multi-input multi-output nonlinear systems has seldom been considered due to the difficulty in dealing with the coupling effects. In this