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A NEW MODEL FOLLOWING DESIGN FOR SECOND-ORDER DYNAMICAL SYSTEMS BASED ON A PARAMETRIC APPROACH

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Abstract. *The model following control of a class of second-order dynamical systems is studied based on a parametrical approach. The form of the controller is established; the existence conditions of the model following controller are deduced; then the complete parametric expressions of the controller gains are presented based on a parametrical solution of a class of second-order Sylvester matrix equations; a simple and effective algorithm is concluded; in the end, a numerical example is given to show the effect of the proposed method.*
Keywords: Second-order dynamical systems, Parametrical method, Model following

1. **Introduction.** Second-order dynamical systems capture the dynamic behaviors of many natural phenomenas, and have found wide applications in many fields, such as vibration and structural analysis, spacecraft control and robotics control, and hence have attracted much attention. Most of the results are focused on stabilization [1-4], pole assignment [5-7], eigenstructure assignment [8-13], observer design [14-16] and robust design [17-22], while a little research has been done on model following [23-25].

This paper is an extended version of [23]. In which, the controlled system is a normal second-order system, the reference model is an autonomous system. Different from that, the paper will study the model following of second-order dynamical systems, and the controlled system and the reference model are all normal second-order systems. In the model following control, the performance of the reference model represents the desired requirement of the controlled system, thus the new model following control has more application because the reference model can describe more performance.

The whole paper is divided into six sections. In Section 2, the problem of model following control for a class of second-order dynamical systems is presented. In Section 3, the structure of the controller is given. In Section 4, based on a complete parametric solution to a class of the second-order generalized Sylvester matrix equations, all controller gain matrices are parameterized. In Section 5, an illustrative example is examined. Concluding remark follows in Section 6.