

FEEDBACK CONTROL FOR PARABOLIC DISTRIBUTED PARAMETER SYSTEMS WITH TIME-DELAY

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ABSTRACT. *The feedback control problem for the parabolic distributed parameter systems with time-delay is investigated. The system model contains time-delay factors in both the diffusion term and the convection term. By using the Lyapunov functional method, the feedback control law is designed for this system. And a simulation example is presented to illustrate the effectiveness of the proposed method.*

Keywords: Distributed parameter systems, Feedback control, Stability, Time-delay

1. **Introduction.** Distributed parameter system (DPS) is a class of important processes in which the process variables vary in space as well as in time. The description of DPS often takes the form of the partial differential equations (PDEs). A great deal of process and control engineering, e.g., steel-making, fluid heat exchangers, some chemical reactors, polymer processing operations, can be described by the DPS as seeing in [1,2].

Recent years, considerable research effort has been concentrated on the control problem of the parabolic DPS. And, many research methods have been proposed. Standard control approaches to this kind of systems are based on the spatial discretization of the original PDEs to obtain a set of ordinary differential equations (ODEs), which allows us to employ the standard finite-dimensional methods to construct the controller as illustrated in [3-5]. However, this approximation technique has shortcoming that the control performance is limited due to the inaccuracy of the models. In order to improve the control performance, some researchers have paid their attentions on developing efficient control performance using accurate DPS models in [6-16]. However, these system models in above references are described by the abstract differential equation. And the semi-group theorem and the spectral decomposition techniques, which are usually hard to be accepted by the engineers, are applied to settle the control problem of these systems. In addition, the influences on the system states which are caused by the time delay factors have not been considered in these systems, too. So it is necessary to study the control problem of the DPS described by the accurate PDEs with time delay. At present, there are few results involving the control problem for the time-delay DPS.

In this paper, we investigate the control problem of a class of DPS described by the parabolic PDEs with time delay. The system model contains both the diffusion term and the convection term. By constructing Lyapunov function and employing linear matrix