International Journal of Innovative Computing, Information and Control
Volume **5**, Number **9**, September **2009**

ICIC International ©2009 ISSN 1349-4198
pp. **2689–2702**

SLIDING MODE CONTROL FOR A CLASS OF PARABOLIC UNCERTAIN DISTRIBUTED PARAMETER SYSTEMS WITH TIME-VARYING DELAYS

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Received February 2008; revised September 2008

Abstract. *The sliding mode control problem for a class of parabolic uncertain distributed parameter system with time-varying delays is investigated. The decomposing theorem of the sliding mode control systems is used to synthesis this system. Firstly, the stability problem for the reduced order sliding motion equations is studied and a sufficient condition of asymptotical stability for the sliding motion is derived. Then the sliding mode controller is designed to ensure that the state trajectory from any initial place reaches the sliding manifold in finite time. A simulation example is presented to illustrate effectiveness of the proposed method.*

Keywords: Distributed parameter systems, Sliding mode control, Uncertain, Time-varying delay

1. **Introduction.** Distributed parameter system (DPS) is a class of important processes in which process variables vary in space as well as in time. In fact, almost all natural and industrial processes are distributed in nature, and a great deal of process and control engineering, e.g. steel-making, fluid heat exchangers, some chemical reactors and polymer processing operations, belong to the DPS in [1,2]. The description of DPS often takes the form of partial differential equations (PDEs).

Over the recent years, there were many researchers to concentrate theirs considerable efforts on the design of control policies for DPS. A standard approach is to spatially discretize the original PDEs to obtain a set of ordinary differential equations (ODEs). Then we can employ standard finite-dimensional methods to construct the controller of the ODEs in [3-5]. However, this approximation technique is inaccuracy and limited. At present, there have been a lot of other research methods. One method of them is based on spectral decomposition techniques, which takes into account the spatially distributed nature of these systems. Taking advantage of the spatial differential operator structure and the Galerkin method, we can use a low-dimensional set of ODEs to approximate the original system and design the controller in [6-8]. By representing DPS with their dominant finite-dimensional modes such as eigenfunctions or singular functions, we also can design the controller for a class of DPS in [9,10]. Recently, the adaptive approach and back-stepping method for DPS have been brought forward in [11,12].