Regional Weak and Strong Stabilization of Time Delay Infinite Dimensional Bilinear Systems

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Abstract: The current study focuses on the regional stabilization of time delay infinite dimensional bilinear systems evolving in a spatial domain Ω. It consists in studying the asymptotic behavior of such a system in a subregion ω of Ω. Then we demonstrate regional weak stabilization under weak observability conditions, while regional strong stabilization can be achieved under the exact observability condition. Illustrative examples and simulations are included to affirm the accuracy of the theoretical results.

Keywords: *infinite dimensional systems; delay bilinear systems; regional stabilization; weak and strong observability.*

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1 Introduction

There has been a growing interest in the study of infinite dimensional bilinear systems, which are a type of nonlinear systems that exhibit nonlinearity as a result of the interaction between the state and control. These systems are widely used in various industrial and natural processes, including heat transfer through conduction-convection, neutron kinetics in nuclear reactors, and dynamic heat exchanger with a controlled flow [3], among others. Bilinear systems are also often used as simple approximations for nonlinear systems [6]. In some cases, time delay may also be present in the system variables, either due to intrinsic delays or due to delays in the reaction of the control. This makes it important to consider time delay when designing these systems to accurately reflect real processes. Bilinear systems with time delay can be found in the fields such as viscoelasticity, mechanics, nuclear reactions, heat flow, and neural networks, etc [9].

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