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ROBUST STABILIZATION OF INFINITE DIMENSIONAL SYSTEMS UNDER UNBOUNDED STOCHASTIC PERTURBATIONS WITH UNBOUNDED INPUT OPERATOR

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Abstract. Based on the stability radius approach, the paper proposes the robust stabilization of infinite dimensional systems subjected to stochastic structured unbounded perturbations with unbounded input operator. The maximization of the stability radius by state feedback is studied. Some conditions for the existence of suboptimal controllers in terms of a Riccati equation are introduced. An operator inequality is then given. Moreover, a lower bound for the supremal achievable stability radius is obtained. Two illustrative examples of the results are presented.

Keywords. Riccati equation, stability radius, stochastic perturbations, unbounded input operator.

AMS (MOS) subject classification: 93E15, 93D09, 93C25.

1 Introduction

Recently, researchers from the mathematical and engineering communities have paid close attention to the system robustness analysis that occurs in a wide range of applications. In a large number of research papers, the concept of stability radii introduced in [6] has been applied and analyzed for various classes of systems. Hinrichsen and Pritchard presented the concepts of real and complex stability radii for finite-dimensional linear systems where they discussed some of their properties. After that, they extended it for other systems classes and types of uncertainty. There are formulas for the stability radius with respect to various classes of perturbations for finite-dimensional time-invariant systems, (see [8, 9]). Many other types of linear dynamical systems have been studied, including time-varying and time delay systems, implicit systems, positive systems, linear systems in infinite-dimensional spaces, and linear systems with stochastic perturbations, (cf. [3, 4, 5, 10, 16]).

For a known asymptotically stable system $\dot{x}(t) = Ax(t)dt$, its stability radius is the maximal $\rho > 0$ such that all the systems of the form $\dot{x}(t) = (A + D(\Delta)E)x(t), \|\Delta\| < \rho$ are asymptotically stable. Both D and E