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ROBUST STABILITY OF POSITIVE LINEAR SYSTEMS UNDER FRACTIONAL PERTURBATIONS IN INFINITE DIMENSIONAL SPACES

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Abstract. In this paper we study the stability radii of positive linear discrete system under fractional perturbations in infinite dimensional spaces. It is shown that complex, real, and positive stability radii of positive systems coincide. More importantly, computable formulas of these stability radii are also derived. The results are then illustrated by a simple example. The results obtained in our paper are extensions of the recent works in [3, 8].

Keywords. positive difference equations, fractional perturbations, stability radius.

AMS (MOS) subject classification: 93D09, 39A11, 93C25, 93C25.

1 Introduction

In the last two decades, a considerable attention has been paid to problems of robust stability of dynamic systems in infinite-dimensional spaces. The interested readers are referred to [2, 3, 4, 5, 8, 9, 10, 12, 18] and the biography therein for further references. One of the most important problems in study of robust stability is the calculation of the stability radius of a dynamic system subjected to various classes of parameter perturbations. In this paper we study the robust stability of infinite-dimensional positive discrete- time systems subjected to arbitrary affine perturbations. Our aim is to generalize some results of [3, 8] to systems in Banach spaces. Recall that the main problem in the study of robust stability of the dynamical system $x(k+1) = Ax(k)$ under affine perturbations is to characterize and compute its stability radius which can be simply defined as the smallest (in norm) complex or real perturbation Δ_i for which the perturbed system

$$x(k+1) = (A + \sum_{i=1}^{N} D_i \Delta_i E_i)x(k)$$