About the robustness of the middle stabilizing controller for quasi-linear state dependent coefficients discrete-time systems

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Abstract: This paper is dedicated to the robustness analysis of a stabilizing controller for quasi-linear state dependent coefficients discrete systems. Two nonlinear stabilizing regulator construction algorithms based on different versions of the discrete state dependent Riccati equation are discussed, the one from [1], [2] and the new one based on the discrete maximum principle. The robustness or fault-tolerance is the property of the regulator that allows it to maintain the control quality if the parameters of the real model differ from the computational model. There are different approaches for robustness analysis, for example the Afanas'ev minimax method, the robust stability properties of Schur polynomials analogous to Kharitonov theorems, linear matrix inequalities (LMI) approach [3] - [4] etc. Here the interval parametric uncertainties in the linear part of the system are investigated. The proposed nonlinear stabilizing regulator is calculated at the average values of the uncertainty parameters and is used for all realizations of the uncertain system. The basic idea is that the existence of only weak nonlinearity in the system allows us to study its robustness based on the robustness of the corresponding unperturbed discrete linear system. First we consider the linear part of the closed-loop system obtained along the so-called middle controller and then take into account the nonlinear part of the system, by introducing some conditions. The sufficient robustness conditions are formulated in the form of linear matrix inequalities. The results of the numerical experiments that demonstrate the robustness of the closed-loop system are analyzed [5] - [6].

Keywords: nonlinear discrete control systems, SDRE, regulator construction, robustness, stabilization, discrete maximum principle

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