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Design of an Optimal Stabilizing Control Law for Discrete-Time Nonlinear Systems Based on Passivity Characteristic

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Abstract: This paper proposes a passivity-based static output feedback law which stabilizes a broad class of nonlinear discrete time systems. This control law is designed in such a way that an arbitrary cost function is also minimized. A general structure with adjustable parameters is considered for the static feedback law. In order to find these parameters for solving the corresponding optimization problem, the genetic optimization algorithm is utilized. An illustrative example shows the effectiveness of the proposed approach.

Keywords: *nonlinear discrete-time systems; passivity-based control; optimal control; genetic optimization algorithm.*

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1 Introduction

The concept of passivity provides a useful tool for the analysis of nonlinear systems [1,2]. The main motivation for studying passivity in the system theory is its connection with stability [3–5]. A very important result in this field is the well known Kalman-Yakubovich-Popov (KYP) Lemma or Positive Real Lemma (PR) which has been specifically developed in the papers ([6, 7]). Also, Byrnes and Isidori [8] have shown that a number of stabilization theorems can be derived from the basic stability property of passive systems.

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