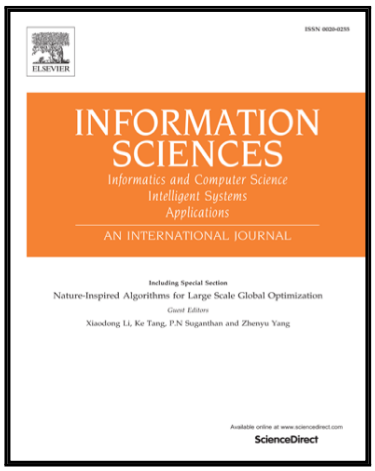

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Policy iteration based robust co-design for nonlinear control systems with state constraints

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Abstract

This paper investigates the robust co-design problem for a class of nonlinear systems with uncertainties and state constraints. Co-design means the simultaneous design of tunable system parameters and the control policy, where a better system performance is usually expected for the nominal dynamics. Different from the existing results, the uncertainties and state constraints are considered in this paper. To handle the state constraint problem, a new transformation method is proposed to convert the dynamics with constraints into an unconstrained one which is still linear with respect to the unknown parameters. Then, based on the existing policy iteration methods, a novel co-design algorithm with a modified cost function is proposed. Moreover, the convergence and the performance improvement of the proposed algorithm is achieved. It is also proved that the stability of the uncertain nonlinear system can be guaranteed by the control policy obtained from the proposed algorithm for the nominal dynamics. In order to guarantee the applicability of the proposed scheme, an approximate algorithm based on the neural network (NN) and the linear matrix inequality (LMI) is presented. Finally, simulation results are given to illustrate the effectiveness of the proposed scheme.

Keywords: Nonlinear systems, policy iteration, co-design, state constraints, uncertainties, neural network.

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