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Feedback Control of Affine Nonlinear Singular Control Systems

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Abstract

This paper discusses feedback control problems like regularization, noninteraction and linearization, for affine nonlinear singular systems. First, based on the constrained dynamic algorithm in affine nonlinear systems, an algorithm is introduced. By using such an algorithm, sufficient and necessary conditions are derived for the solvability fof regularization problem. Then, another algorithm is proposed, based on which a sequence of integers can be defined for the system. It is shown that under some mild conditions, the dynamic part of singular systems can be linearized by using a regular feedback. Finaly, an example is provided to illustrate the main results.

Keywords: Singular systems, nonlinear control systems, regularization, noninteracting control, linearization.

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A Note on Damped Algebraic Riccati Equations

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Abstract

In a recent paper, an algorithm which produces dampening controllers based on a periodic formulation of Hamiltonian systems was proposed. Central to this algorithm is a formulation of symmetric and skew-symmetric damped algebraic Riccati equations. It was shown that each of the two solutions leads to a dampening feedback, *i.e.,* a stable closed–loop system for which the real parts of the eigenvalues are larger in modulus than the imaginary parts.
In this paper, we extend these results to include a broader class of Hermitian and skew-Hermitian solutions and show that every convex combination of these solutions produces a dampening feedback. This property can be used to vary the feedback with two parameters and thus obtain more flexibility in the controller design process.

Keywords: dampening feedback, damped system dynamics, periodic Schur decomposition, periodic Riccati equation, Hamiltonian systems, linear quadratic control