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The Quotient Singular Value Decomposition and the Periodic QZ Decomposition

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Abstract

The periodic Schur decomposition has been generally seen as a tool to compute the eigenvalues of a product of matrices in a numerically sound way. In a recent paper, it was shown that the periodic Schur decomposition may also be used to accurately compute the singular value decomposition of a matrix. If this technique is extended to the periodic QZ decomposition, then it is possible to compute the quotient singular value decomposition (QSVD) of a matrix pair. This paper elaborates how the periodic QZ decomposition may be used to compute stably and accurately the orthogonal, non-orthogonal, and non-negative definite diagonal matrices associated with the QSVD. Further, this technique may easily be extended to a sequence of matrix pairs, thus computing the "periodic" quotient singular value decomposition.

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Diophantine Equations in Control - A Survey*

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Abstract

This is a tutorial whose aim is to explain the role of diophantine equations in the synthesis of feedback control systems. These are linear equations in a ring and result from a fractional representation of the systems involved.

The cornerstone of the exposition is a simple parametrization of a stabilizing controller for a given plant. One can then choose, in principle, the best controllers for various applications.

These ideas evolved from early attempts to use polynomial equations in the design of discrete-time linear systems. By now they have been extended to continuous-time, infinite-dimensional, time-varying and non-linear systems.

Keywords: Diophantine equations, polynomial equations

* The original version of this paper was presented at the First European Control Conference, which was held in Grenoble, France during 2 - 5 July 1991.

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A Necessary and Sufficient Condition of Output Feedback Stabilizability*

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Abstract

A necessary and sufficient condition for a linear system to be stabilizable via static output feedback is presented. It makes an appeal to the linear–quadratic regulator theory.

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The Pole Placement Equation - A Survey

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Abstract

We consider the linear equation $AX + BY = C$ where A, B and C are given polynomials from $K[s]$, the ring of polynomials in the indeterminate s over a field K, and X and Y are unknown polynomials in $K[s]$.

Keywords: Linear systems; state feedback; decoupling; interlacing inequalities.

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Eigenstructure Assignment in Linear Descriptor Systems*

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Abstract

Given a linear controllable system $E\dot{x} = Fx + Gu$, we study the limits of linear proportional feedback $u = Kx + v$ in assigning a desired finite and infinite eigenstructure of the closed-loop system $E\dot{x} = (F+GK)x+Gv$. The closed-loop system is not restricted to be regular; its rank makes part of the specifications.existence of a feedback gain K which assigns the desired eigenstructure, and a procedure is outlined to calculate one such gain.

Keywords: Linear systems; Eigenstructure assignment; State feedback; Controllability; Matrix polynomial equations.

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Dynamics Assignment by PD State Feedback in Linear Reachable Systems*

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Abstract

The limits in altering the eigenstructure of linear reachable descriptor systems by proportional-and-derivative (PD) state feedback are studied. Necessary and sufficient conditions are established for a set of invariant polynomials and positive integers to represent the finite and the infinite eigenstructure of a system obtainable from the given descriptor system by PD state feedback. The result implies a constructive procedure to calculate the actual feedback gains.

Keywords: Descriptor systems, eigenstructure, state feedback

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