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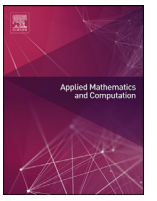

Perturbation theory of structured matrix pencils with no spillover

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ABSTRACT

This paper aims to determine unstructured or structured perturbations of a matrix pencil such that the perturbed matrix pencil reconstructs a given deflating pair without changing the complementary deflating pair of the unperturbed matrix pencil. If the latter is unknown, then it is referred to as no spillover updating. If the complementary deflating pair of the given pencil is known, then all possible unstructured perturbations are obtained. However, if the complementary deflating pair of the unperturbed pencil is unknown, then we obtain a class of structure-preserving perturbations of the structured pencil. Finally, these results are utilized to obtain parametric solutions of the model updating problem with no spillover for various structured matrix pencils.

1. Introduction

In this paper, we determine structured (unstructured) perturbations such that a perturbed matrix pencil reproduces a desired deflating pair while maintaining invariance of the complementary deflating pair of the unperturbed matrix pencil. Moreover, if the latter pair is unknown, then it is said to be no spillover updating. As a byproduct of this, we determine the perturbation of coefficient matrices of a matrix pencil such that the perturbed pencil reproduces an aimed set of eigenvalues while preserving the remaining eigenpairs (which need not be known) of the unperturbed matrix pencil, which is known as the model updating problem with no spillover [3,8,15,24,33,35]. A detailed study on the existing structured matrix pencils can be found in [1,30,31]. Recently, in [4], authors employed Brauers theorem (see [7]) to replace a few eigenvalues of a structured matrix pencil by the desired scalars without affecting the remaining eigenvalues of the given pencil. A fundamental result developed by Meini [26] states that: Let $P(z)$ be an unstructured matrix pencil and (λ, y) be an eigenpair of $P(z)$. Suppose x is an arbitrary vector satisfying $x^*y = 1$ and μ is an arbitrary complex number. Then $\tilde{P}(z) = P(z)\left(I + \frac{\lambda - \mu}{z - \lambda} yx^*\right)$ is an unstructured matrix pencil such that (μ, y) is its eigenpair, while rest of the eigenvalues of $\tilde{P}(z)$ are the same as the eigenvalues of $P(z)$ except the eigenvalue λ, where I stands for the identity matrix of suitable dimension. Furthermore, Adhikari et al. [1] used an innovative technique to determine the analytical expression of structured pencils that reproduce a

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