Skew Box Enclosure for the Parametric AE Solution Set

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Consider linear algebraic systems $A(p)x = b(p)$ where the elements of the matrix $A(p)$ and the vector $b(p)$ are linear functions of uncertain parameters varying within given intervals, $p_i \in [p_i]$, $i = 1, \ldots, k$. For two disjoint sets $E$ and $A$, such that $E \cup A = \{1, \ldots, k\}$, the parametric AE solution set of the above system is defined by

$$\Sigma_{AE}^p = \Sigma(A(p), b(p), [p])$$

$$:= \{x \in \mathbb{R}^n \mid (\forall p_A \in [p_A])(\exists p_E \in [p_E])(A(p)x = b(p))\}.$$

A single step parametric method, called Bauer-Skeel method, based on the left-preconditioned system, is proposed in [1] for the outer estimation of a parametric AE solution set.

In this talk we present a outer estimate of the parametric AE solution set by right-preconditioning of the parametric matrix. The obtained outer estimate is in the form of a parallelepiped, called skew box. A right-preconditioning version of the parametric Bauer-Skeel method for outer estimation of the parametric AE solution set will be presented. In the special case of parametric united solution set a right-preconditioning version of the parametric fixed-point iteration will be outlined. The properties and the usefulness of the new outer estimation will be discussed on a number of numerical examples.

References