THE UNIVERSITY OF CHICAGO

Department of Statistics
MASTER'S THESIS PRESENTATION

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Spectral Nearness Problems as Multiparameter Singular Value Problems

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ABSTRACT

We introduce a singular value analogue of multiparameter eigenvalue problems that we call multiparameter singular value problems. It contains the standard singular value problem $Au = \sigma v$, $A^* v = \sigma u$ as a special case. We show that a wide range of matrix nearness problems — where given a real or complex matrix A, one asks for the nearest matrix with certain spectral properties — may all be reduced to multiparameter singular value problems. We will see that the distance of A to instability, its Wilkinson distance, its spectral abscissa, could all be determined via a k-parameter singular value problem where $k = 1, 2$ or 3. Likewise, for a real or complex matrix pair (A, B), its spectral separation, its controllability distance are all k-parameter singular value problems where $k = 1, 2, 3$ or 5. In addition, this formulation may also be applied to obtain plots of pseudospectra. Finally, we apply the bisection algorithm combined with homotopy method to solve most of these nearness problems. Numerical results are also provided.