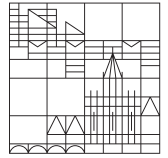


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On the spectral properties of nonsingular matrices that are strictly sign-regular for some order with applications to totally positive discrete-time systems

Rola Alseidi

University of Konstanz, Germany

Abstract. A matrix is called strictly sign-regular of order k (denoted by SSR_k) if all its $k \times k$ minors are non-zero and have the same sign. For example, totally positive matrices, i.e., matrices with all minors positive, are SSR_k for all k . Another important subclass are those that are SSR_k for all odd k . Such matrices have interesting sign variation diminishing properties, and it has been recently shown that they play an important role in the analysis of certain nonlinear cooperative dynamical systems.

The spectral properties of nonsingular matrices that are SSR_k for a specific value k are studied. One of the results is that the product of the first k eigenvalues is real and of the same sign as the $k \times k$ minors, and that linear combinations of certain eigenvectors have specific sign patterns. It is then shown how known results for matrices that are SSR_k for several values of k can be derived from these spectral properties. Using these theoretical results, the notion of a totally positive discrete-time system (TPDTS) is introduced. This may be regarded as the discrete-time analogue of the important notion of a totally positive differential system. It is shown that TPDTSs entrain to periodic excitations.

This work is joint with Jürgen Garloff and Michael Margaliot.