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A Map of Sufficient Conditions for the Symmetric Nonnegative Inverse Eigenvalue Problem*

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Abstract

The symmetric nonnegative inverse eigenvalue problem (SNIEP) asks for necessary and sufficient conditions in order that a list of real numbers be the spectrum of a symmetric nonnegative real matrix. A number of sufficient conditions for the existence of such a matrix are known. In this paper, in order to construct a map of sufficient conditions, we compare these conditions and establish inclusion relations or independence relations between them.

AMS classifications: 15A29; 15A18; 15B51

Keywords: symmetric nonnegative inverse eigenvalue problem, sufficient conditions, nonnegative matrices.

1 Introduction

The *real nonnegative inverse eigenvalue problem* (hereafter RNIEP) is the problem of characterizing all possible real spectra of entrywise nonnegative matrices. This problem remains unsolved. A complete solution is known only for spectra of size $n \leq 4$. A number of *realizability criteria* or sufficient conditions for the existence of a nonnegative matrix with a given real spectrum have been obtained, from different points of view. In [12] the authors construct a map of sufficient conditions for the RNIEP, in which they show inclusion or independence relations between these conditions.

If in the RNIEP we require that the nonnegative matrix be symmetric, we have the *symmetric nonnegative inverse eigenvalue problem* (hereafter SNIEP). For a long time it was thought that the RNIEP and the SNIEP were equivalent, but in [8] it was proved that both problems are different and in [5] that they are different for $n \geq 5$. Both problems, RNIEP and SNIEP, are equivalent for $n \leq 4$ and remain open for $n \geq 5$.

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