

# A Survey of Totally Positive Matrix Completion Problems

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**Abstract.** An  $m \times n$  partial matrix is a matrix in which some of its entries are known while the other entries are free to be selected from a specified set such as the set of real numbers. By completion of a matrix, we mean to find the values of the entries that are not specified so that the resultant completed matrix satisfies certain desired properties.

A matrix is said to be totally positive (TP)(resp. Totally non-negative(TN)) if every square submatrix of it has positive determinant(resp. non-negative determinant). So, in matrix completion problems, we ask which partial matrices have a completion with certain desired properties, whereas the TP completion problem demands which partial matrices have TP Completion. Since sub matrices of a TP matrix are also TP, in order to have a TP completion, the partial matrix must be partially TP.

The objective of this paper is to provide a comprehensive analysis of the methods of TP matrix completion problems.

This paper provides an overview of completion techniques for TP matrices, discussing existing approaches and analyzing their graph-theoretic characterizations. It focuses on the TP completion of specific patterns of unspecified entries in a partial matrix. The paper also characterizes the number of unspecified entries for rectangular matrices of order up to three.

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