

# Nonnegative tensors and their applications

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An  $m$ -order  $n$ -dimensional square real tensor  $A$  is a multidimensional array of  $n^m$  elements of the form

$$\{A = (A_{i_1 \dots i_m}) \mid A_{i_1 \dots i_m} \in \mathbb{R}, 1 \leq i_1, \dots, i_m \leq n.\}$$

(A square matrix of order  $n$  is a 2-order  $n$ -dimensional square tensor). An  $m$ -order  $n$ -dimensional square real tensor is said to be a nonnegative (positive) tensor if all its entries are nonnegative (positive). We shall discuss the Perron-Frobenius theory for nonnegative tensors. Using these results we establish a sufficient condition for the positive semidefiniteness of homogenous multivariable polynomials.