Perron-Frobenius Theory and its Application

Thesis Abstract
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Abstract

In linear algebra, the Perron-Frobenius theorem, proven by Oskar Perron (1907) and Georg Frobenius (1912), claims that the actual square matrix with positive elements has the only most real value and the corresponding own vector can be chosen to have strictly positive components , and also approves a similar statement for some classes of non-negative matrices. Matrices are used to manipulate finite-dimensional vector spaces and linear maps. As a result, their theory is an important aspect of linear algebra and Science.

The research was done by studying positive and non-negative eigenpairs, spectral radius, Jordan normal form, Collatz-Wielandt formula, reducibility, primitive matrices, index, multiplicities of spectral radius and applying this knowledge in different areas. Perron-Frobenius theorem has a crucial part in different theorems and works in different fields of studies, i.e, Physics, Demographics, Economics, Biology, Chemistry, Informatics and etc. The theorem is used in Leontiev input/output economic model, Walrasian stability of competitive markets, Markov chains, PageRank and population(Leslie model). Perron-Frobenius theorem played an important role in the creation of modern internet.

From the results one can see that Perron-Frobenius theorem advanced Science, gave a lot of new brilliant ideas and impacted the whole world.