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## THE IMPORTANCE OF THE PERRON-FROBENIUS THEOREM

MOHAMMAD TAGHI JAHANDIDEH<sup>1\*</sup>

<sup>1</sup> *College of Mathematics, Isfahan University of Technology, Isfahan 84156-83111,  
Isfahan, Iran  
jahandid@cc.iut.ac.ir*

ABSTRACT. The Perron-Frobenius theorem provides a simple characterization of the eigenvectors and eigenvalues of certain types of matrices with nonnegative entries. The importance of the Perron-Frobenius theorem stems from the fact that eigenvalue problems on these types of matrices frequently arise in many different fields of science and engineering. In this paper, we will examine the statement of the Perron-Frobenius theorem and discuss several examples of its use, such as in graph theory, stochastic matrices, Markov chains, power-control problems, and finding PageRank scores.

### 1. INTRODUCTION

The Perron-Frobenius theorem is valuable as it describes several eigenvalue/eigenvector properties that hold true for specific matrices that are actually somewhat common in the real world. These properties help us solve more complex eigenvalue/eigenvector problems. Many real world problems can be written in vector notation, to which we can then apply the Perron-Frobenius theorem to arrive at a solution.

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\* Speaker.