

## Resume

The essential topic of this memory is the study of H-matrices as they were introduced by Ostrowski and hereinafter extended and developed by different authors. In this study three slopes are outlined: 1) the iterative or automatic determination of H-matrices, 2) the properties inherent in the H-matrices and 3) the matrices related to H-matrices.

H-matrices acquire every time major relevancy due to the fact that they arise in numerous applications so much in Mathematics, since in the Industry between. Between these applications we can mention the following ones: 1) in the discretization of certain parabolic non-linear equations, 2) in the system resolution of linear equations, assuring his presence the convergence of iterative classic methods and 3) in the resolution of problems of free contour in Analysis of Fluids.

It is very important to observe that some H-matrices transform in H-matrices for the action of some matrix operation on them. Such it is the case of the matrix operation known as Hadamard's Product, that is to say, the product element to element of two matrices. If this product realizes between the elements of a matrix and the elements of its inverse transpose then this matrix product is called combined matrix. The combined matrix is an H-matrix under certain conditions of the original matrix and, in addition, the combined matrix is linked to applications very important as the Relative Gain in chemical processes or the relation between the eigenvalues of the original matrix and the elements of a diagonalizable matrix. In addition, provided that the sum of every row and of every column is equal to one, in those cases in which the combined matrix is not negative,  $C(A)$  is a doubly stochastic matrix and therefore it is of great usefulness in the Statistical Theory.

The present memory is structured of the following way. In the first chapter, after the introduction, we present the notation, the basic concepts and previous results developed by other authors and that are going to be used largely in the memory.

In the Chapter 2 we present and analyze different algorithms that have been proposed by the aim to determine when a given matrix is or is not an H-matrix. It is emphasized in the study of those algorithms that have turned out to be the most efficient and in the most relevant part of this chapter we present a new algorithm that turns out to be a contribution to the literature of the algorithms for the determination or identification of H-matrices, as well as of his character.

In the Chapter 3 we widely studied the combined matrix of a nonsingular H-matrices and we obtain new and important properties of the combined matrix of H-matrices.

In the Chapter 4 we calculate the combined matrix of diagonally dominant and equipotent matrices and also we obtain new and important results that relate the combined matrix of these diagonally dominant and equipotent matrices to H-matrices.

In Chapter 5, like summary, we outline the principal achievements reached during the development of this memory and, in addition, enumerate the works on which already we are working and also we present some of the principal lines of investigation for the near future.

Finally, in the appendices we present, in format MATLAB, different algorithms studied in Chapter 2 that make the automatic determination of H-matrices as a purpose. Especially, is outlined the codification of the new algorithm proposed with each of its parts in the correct order to be run in the computer.