

Fast Algorithms for Solving Toeplitz and Bordered Toeplitz Matrix Problems Arising in Electromagnetic Theory

Ho, Min-Hua; Chen, Mingchih

Abstract

In many electromagnetic field problems, matrix equations were always deduced from using the method of moment. Among these matrix equations, some of them might require a large amount of computer memory storage which made them unrealistic to be solved on a personal computer. Virtually, these matrices might be too large to be solved efficiently. A fast algorithm based on a Toeplitz matrix solution was developed for solving a bordered Toeplitz matrix equation arising in electromagnetic problems applications. The developed matrix solution method can be applied to solve some electromagnetic problems having very large-scale matrices, which are deduced from the moment method procedure. In this paper, a study of a computationally efficient order-recursive algorithm for solving the linear electromagnetic problems $[Z] I = V$, where $[Z]$ is a Toeplitz matrix, was presented. Upon the described Toeplitz matrix algorithm, this paper derives an efficient recursive algorithm for solving a bordered Toeplitz matrix with the matrix's major portion in the form of a Toeplitz matrix. This algorithm has remarkable advantages in reducing both the number of arithmetic operations and memory storage.