ABSTRACT

A full solution to the radiation and scattering problem of large microstrip antenna arrays using integral equation method is presented. The solution begins by the formation of mix-potential integral equation. The integral equation is then solved by method of moment using RWG basis functions and layered medium's Green's functions. Furthermore, a novel single dual rank singular value decomposition (SVD) algorithm is introduced that efficiently compresses the resulting dense MOM matrix. For a system of N equations, an amount of work of the order $O(N^2)$ has traditionally been required for both matrix assembly and matrix-vector multiplication in an iterative solver. The algorithm of the present paper reduces the memory requirement and CPU time for both matrix assembly and matrix-vector multiplication to $O(N^{3/2})$ making it practical to solve for large antenna arrays with full wave approach. In conjunction with a "geometric-neighboring" preconditioner for matrix solution using GMRES, the current approach solves large antenna arrays using only a fraction of what are needed by conventional MOM both in terms of memory and total CPU time. Finally, we validate our results and demonstrate the claimed benefits through a few microstrip patch antennas and antenna arrays.