Efficient Generation of Method of Moments Matrices Using the Characteristic Function Method

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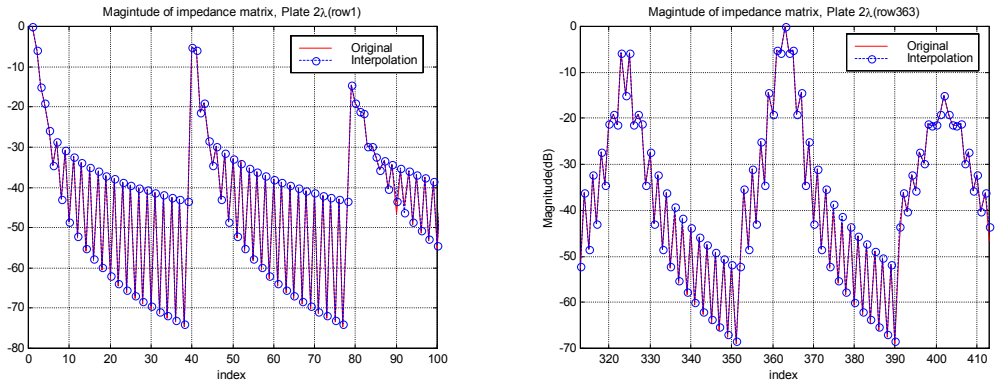
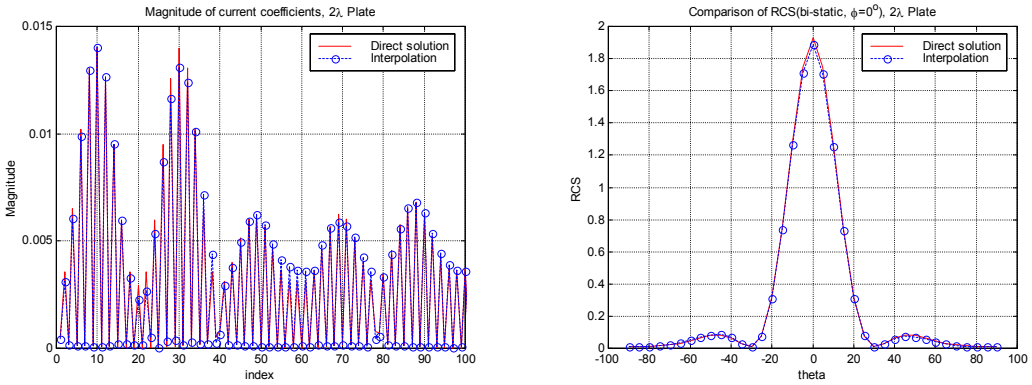
In the conventional MoM using the sub-sectional basis functions, and a λ/10 or λ/20 discretization, the computation of the MoM impedance matrix elements consumes a considerable portion of the total solution time as the problem dimensions become large in terms of the wavelength, because the matrix generation requires $O(N^2)$ operations, where N is the number of unknowns. In this paper, we investigate the Degrees of Freedoms (DoFs) of the MoM matrix elements and show that they can be represented in terms of a very small number of Characteristic Functions. We then take advantage of this fact by generating the elements without having to perform the usual integration involving the basis, testing and Green's functions, except for a few entries that we computed directly. The results below, for a 2λ square plate as a case example, show that the matrix elements, current coefficients and the RCS all agree very well with the direct calculations, which, of course, are considerably more CPU intensive, both in terms of storage and time.



(a) (b)

Fig. 1. Comparison of magnitude of impedance matrix: (a) row 1; and (b) row 363.



(a) (b)

Fig. 2. Comparison of current coefficients and radar cross section (RCS): (a) current coefficients; and (b) RCS.