ELECTROMAGNETIC SCATTERING DUE TO POLYGONAL SHAPED THIN METALLIC PLATES USING HYBRID ELEMENTS

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SUMMARY

Electromagnetic (EM) scattering analysis of polygonal shaped metallic plates can be accomplished by using various numerical techniques. One of the widely used techniques is the MoM in which a polygonal plate is first discretized into number of triangular patches called subdomain patches. The unknown surface current density on these subdomains is then expressed in terms of well known Rao-Wilton-Glisson (RWG) (S. M. Rao, D. R. Wilton, and A. W. Glisson, IEEE Trans. On Antennas and Propagation , Vol. AP-30, no. 3, pp. 409-418, May 1982) basis functions and determined using the EFIE in conjunction with the method of moments. Although, the triangular meshing and use of RWG basis functions is very popular and matured concept, the non-vanishing normal component of surface current on one of the inclined edges of sub-domain triangles attached to open /boundary edge of polygonal plate will give a non-zero normal component of the surface current. However, the non-zero normal component of the surface current on the boundary edge will approach zero when very fine discretization is used in the region close to the open/boundary edges. This problem will not arise if one uses a subdomain element (near the bounary) whose edges will be either along the boundary or normal to the boundary. For example, a quadrilateral element can be assigned to open/boundary edges of polygonal plate to satisfy such requirement. Use of quadrilateral elements along the open/boundary edges and trinagular elements over the interior region will improve the convergence of the MoM solution.

In this paper a numerical method will be presented to estimate electromagnetic scattering due to polygonal shaped thin metallic plates using 1) trinagular, 2) quadrilateral, and 3) triangular/quadrilateral meshing. Through numerical examples, advantages and disadvantages of each scheme will be demonstarted as far as the numerical convergence is concerned. Figure 1a shows a triangular plate with a triangular hole (a = 5.08cm, b= 2.54 cm, frequency =11.811GHz). Figure 1b shows monostatic EM scattering due to the plate (shown in Fig . 1(a)) illuminated by E-polarized plane wave in the y-z plane using pure triangular and quadrilateral meshing schemes .

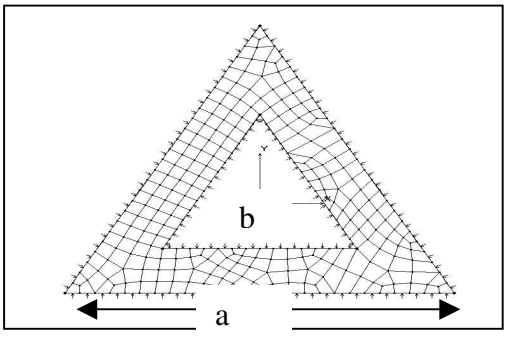

Figure 1(a)

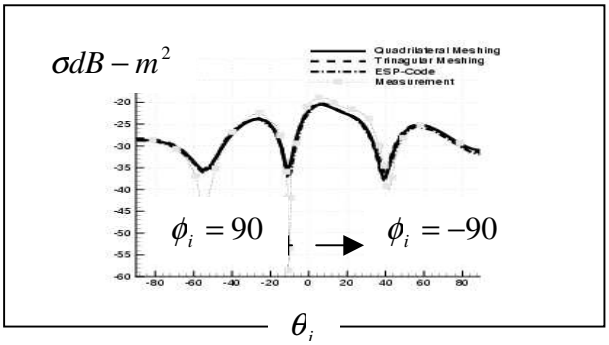

Figure 1(b)