URSI AP-RASC 2019, New Delhi, India, 09 - 15 March 2019

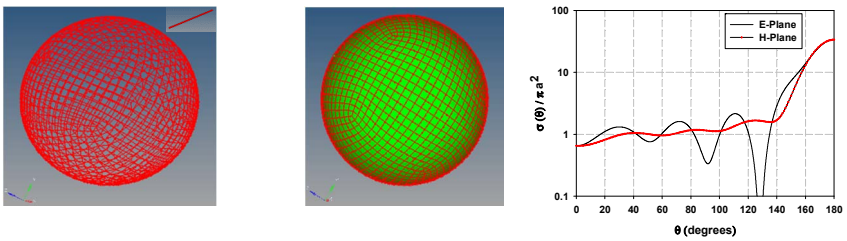
RCS Computation of Canonical Aerospace Structures using Parallelized Numerical Method and Hypermesh

Vineetha Joy*(1), Hema Singh (1), and R.U. Nair (1)
(1) Centre for Electromagnetics (CEM), CSIR-National Aerospace Laboratories, Bangalore, 560017
e-mail: vineethajoy@nal.res.in; hemasingh@nal.res.in; raviunair@nal.res.in

The rapid advancements in the field of aerospace technologies are continuously opening up fresh challenges with respect to radar cross-section (RCS) prediction and measurements. The present paper focuses on the application of Altair HyperMesh in the computation of RCS of canonical aerospace structures using a parallelized version of method of moment (MoM) based numerical electromagnetics code (NEC), one of the most popular and accurate open source MoM codes available till date. The workflow for wire-grid modelling in HyperMesh has been identified and the segmentation data has been extracted from the mesh output of HyperMesh using an indigenously developed extraction algorithm and then converted to the format compatible with NEC. Unlike commercial solvers, with the application of HyperMesh in conjunction with the newly developed extraction algorithm, the user gets more access and control over the generation of accurate mesh for EM simulations.

NEC is a versatile program used for the electromagnetic (EM) analysis of metallic structures in the presence of incident fields [1]. The popularity of NEC even in the presence of commercial MoM solvers can be attributed to the availability of the well-documented powerful computational engine, which can be used as a foundation for further developments in the area of EM analysis of electrically large airborne platforms. Although, numerical methods like MoM are suitable for a wide range of problems, computations become exhaustive with increase in the electrical size of the object. A parallelized version of NEC as in [2] has been used here to alleviate this problem.

One of the most complex and tedious steps in NEC is the generation of segmentation data in a compatible format. It is an extremely time-consuming and error prone process. The inclusion of HyperMesh in the modelling process has greatly simplified the pre-processing step and the pre-processing time will be reduced drastically. This novel modeling procedure has been used to compute the RCS of canonical aerospace structures like dihedral, sphere, NASA almond, ogive etc. The typical case of a PEC sphere is illustrated here and the results obtained have been validated with those in [1]. The application of HyperMesh will make NEC more user-friendly and will promote its usage as a foundational platform for the development of MoM based hybrid solvers.



(a) (b)

Figure 1. (a) Wire grid model of PEC sphere in HyperMesh (b) Bistatic RCS of PEC sphere from NEC

1. G. Burke and A. Poggio, Numerical electromagnetics code (NEC)—Method of moments, Lawrence Livermore National Laboratory, Livermore, CA, Technical Document, Rep. UCID-18834, 719p., January 1981.

2. A. Rubinstein, F. Rachidi, M. Rubinstein, and B. Reusser, "A parallel version of NEC for the analysis of large structures," *IEEE Transactions on Electromagnetic Compatibility*, **45**, 2, May 2003, pp. 177–188, doi: 10.1109/TEMC.2003.810806.