CEM NEWS FROM EUROPE

Pat Foster

This year ACES (UK) devoted its one day meeting on September 22nd to Modeling Ships. 25 people turned up at Imperial College, London, for the event which was very lively.

The morning was devoted to a short course on the software package 'SHIP EDF' which has been developed by the Italian firm, IDS, based in PISA [1]. This is a major European package dealing with CEM modeling in all its forms for ships.

Tim Murphy who is head of Electromagnetics on the BAE Systems Ship team at Filton gave an over-view of problems in predicting EM performance on ships. He took as his example a Flight 1A Arleigh Burke Class destroyer which has a length of 155m and a beam of 20 mm. The frequency range of equipment is from 1 MHz to 18 GHz. He took three very different areas of prediction as examples. The first was an HF model which is treated with MoM techniques and is capable of identify hot spots around the ship so that operational constraints can be set at an early stage in the ship design. The second was a surveillance radar where he showed the volumes within which levels of 200v/m were exceeded. Again this enables operational constraints, particularly as regards helicopter safety, to be set well in advance. As a third example, he discussed below-decks equipment for de-gaussing where Vector Fields' TOSCA was used. This showed the crew must be protected. Tim Murphy pointed out that there was not much evidence around on the effects of long-term exposure of humans to such fields.

There was an interesting discussion on the use of electric motors for warships. These are coming into use for cruise ships where the release of internal space and the quietness is an attraction but there are serious problems in warship use.

The major presentation of the morning was from Stephano Chiti of IDS. The software package covers antenna installed performance, EMC and RCS and IR signatures. As you might expect, a great deal of the package is devoted to data management such as configuration control (dealing with the many different versions of any one ship design), a library of antennas and materials. The work flow for a single example was worked through. Clearly the amount of data required is very large and importing the ship geometry is a major exercise. Configuration control is required so that traceability is maintained. The IDS website [1] does contain some data on EDF. The methods employed are Method of Moments, Physical Optics and GTD. High gain antennas are modeled using electric and magnetic dipoles in front of a flat plate.

The output can be in the form of a Risk Assessment.

A major section of the course was devoted to validation and the accuracy required. There is the usual problem that, in comparing predictions with measurements, it is assumed that all the errors are in EDF. In the case of special measurements made as Funtington, DERA, UK, on a mock-up mast it could clearly be seen that the security fence was affecting radiation patterns. A large number of measurements were made in this trial on antenna patterns and coupling as well as field strength. These all showed the program to be as accurate as required by the customers. There was a discussion

on the setting of standards for agreement in that the accuracy required was +/- 4 dB over 0.0 to –20 dB below peak and some of the audience thought this should be related to dBi not relative decibels.

Future developments involve the incorporation of hybrid methods and some numerical experiments have been carried out using a mixed of MoM and PO on a dipole antenna near to two masts. These experiments range from a full MoM prediction to a prediction using MoM for the antenna alone and PO for the mast interactions which reduce the runtime from 41549 seconds to 839 seconds. The radiation patterns were clearly in error in the shadow region for the last method. Other developments would be the incorporation of a TLM approach to FSS materials and the modeling of layered materials.

This is a very powerful program which is slanted towards the systems aspects and intended to help the ship designers decide on details of the ship's structure and layout.

There was also a demonstration of EDF. The program operates on UNIX or NT and assumes that team operation is required by the customer – another reason for requiring careful configuration control. Multiple CPUs can be used when dealing with (say) HF antennas on the ship using MoM.

Several papers related to ship modeling were presented in the afternoon. These papers deserve a lengthy exposition for each one. All I shall do here is to list the papers so more detail can be obtained directly from the author

Waseem Qureshi, (Bae Systems ATC, Great Baddow, UK), 'EM modeling of the Sampson Radome'
M El Hachemi, (Swansea University, UK), 'Low-Order Method for Solving Electromagnetic Scattering Problems'
A J Keddie, Imperial College, London, UK, and M D Pocock (Frazer Nash Consultancy), 'Static Ship Signature Modeling'
A Duffy (de Montfort University, Leicester, UK), A Drozd (ANDRO Com Soltns, Rome, USA) and B Archambeault (IBM, NC, USA), 'Towards Validating CEM Modeling'
A J Cottee, M Rayner and C Parini, (QMW College, London, UK), 'Antenna Analysis using Discrete Green's Function FDTD Method'
S P Benham, J Lord (BAE Systems ATC, Gt Baddow) and J Burbage (BAE Systems, CDI, Filton, UK), 'Challenges in the CEM Modeling of Ships'

1. Website at www.ids-spa.it