JINA 2006 TESTCASE 4: PLACYL

This test case was one of the test cases in the JINA 2006 Workshop. The test case deals with the diffraction of a plane wave by a set of perfectly conducting half sphere and cylinder located over a perfectly conducting finite surface.

Definition of geometry

The radius of the half sphere is R; R=0.2 m. The length of the cylinder is L; L=1 m. The dimensions of the finite metallic surface is AxB; A=1.8 m, B=1.2 m. The gap between the cylinder and the perfectly conducting surface is H; H=0.02 m The centre of the cylinder is the origin of the coordinate system.

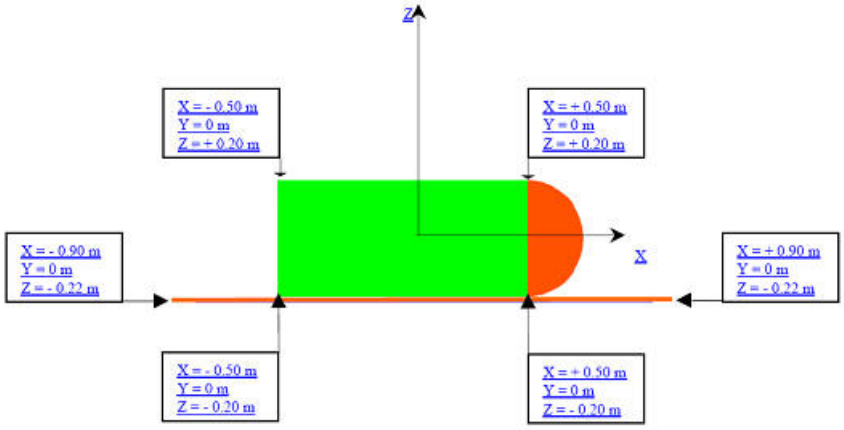

Figure 1: Geometry of the placyl test case

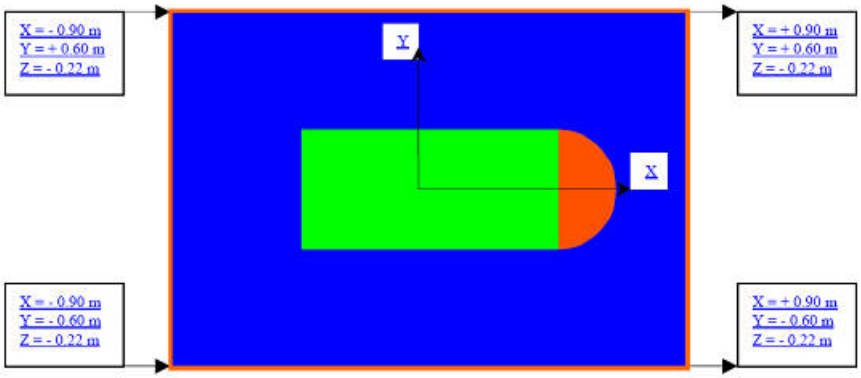

Figure 2: Geometry of the placyl test case

Simulation with efield

The RCS was computed using the EfieldFD MLFMM solver at frequencies 5GHz and 10GHz.

Bistatic RCS at 5GHz and 10GHz in two cuts:

- Bistatic RCS in the upper x-z plane for incident plane wave excitation at theta 50 degrees and phi 0 degrees (Bistatic RCS along cylinder)
- Bistatic RCS in the upper y-z plane for incident plane wave excitation at theta 50 degrees and phi 90 degrees (Bistatic RCS across cylinder)
- Polarizations: θθ and φφ

Monostatic RCS at 10 GHz for:

- Incident angles: theta 45 degrees and phi from 0 to 180 degrees with a 1 degree step
- Polarizations: θθ and φφ

In Figure 3 the bistatic RCS at 5GHz along the cylinder is shown, in Figure 4 the bistatic RCS at 5GHz across the cylinder is shown. In Figure 5 the bistatic RCS at 10GHz along the cylinder is shown and in Figure 6 the bistatic RCS at 10GHz across the cylinder is shown. In Figure 7 the surface currents for the bistatic simulation at 5GH with plane wave excitation with incident plane wave at theta 50 degrees and phi 0 degrees and theta polarisation is shown.

In Figure 8 the monostatic RCS at 10GHz is shown.

The results obtained using efield agree very well with other results presented during the workshop.

The problem was solved using the EfieldFD Multi Level Fast Multipole Method. A Combined Field Integral Equation (CFIE) was used to speed up the convergence. The simulation was run on one processor for the bistatic cases and on four processors for the monostatic case on an AMD Dual Core Opteron 285 2.6 GHz with 16 Gb memory.

Simulation timing results are shown in Table 1 and Table 2.

Table 1: Simulation data for the placyl test case. Bistatic RCS.

Frequency	Number of unknowns	Number of elements	Mesh resolution	Memory	CPU-time
5 GHz	525840	350560	10 edges per wavelength	6.4 Gb	1.4 hours
10 GHz	1167312	778208	7,5 edges per wavelength	13 Gb	5 hours

Table 2: Simulation data for the placyl test case. Monostatic RCS

Frequency	Number of unknowns	Number of elements	Mesh resolution	Memory	CPU-time (total)	CPU-time (assembly)	CPU-time (solve)
10 GHz	1167312	778208	7,5 edges per wavelength	13 Gb	126 hours	1.7 hours	124 hours

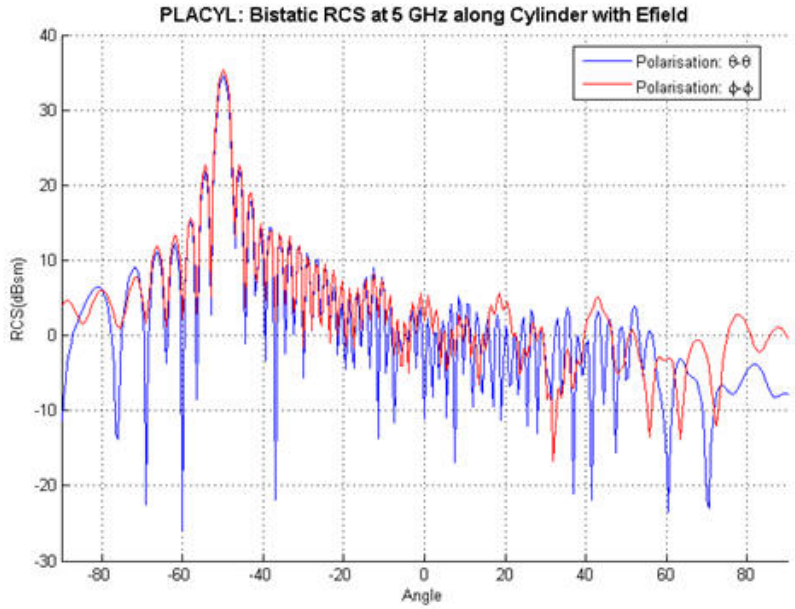

Figure 3: Bistatic RCS at 5GHz along cylinder

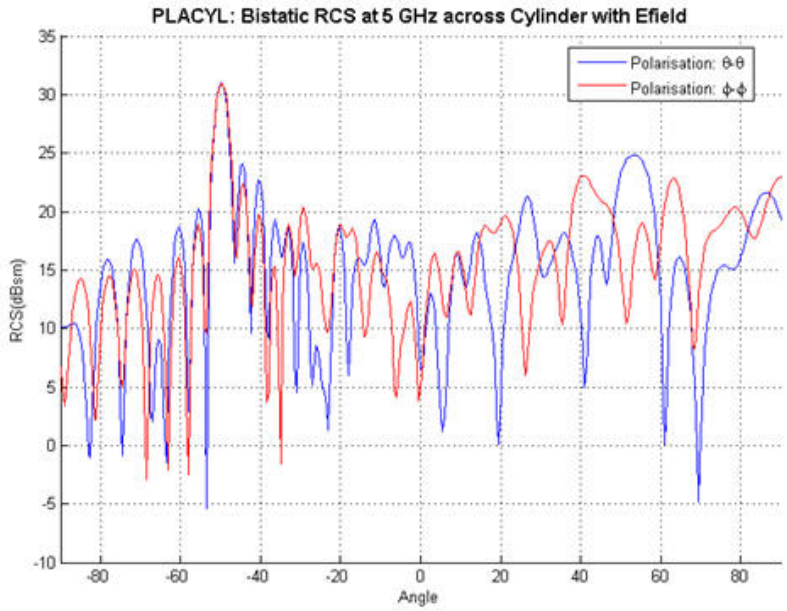

Figure 4: Bistatic RCS at 5GHz across cylinder

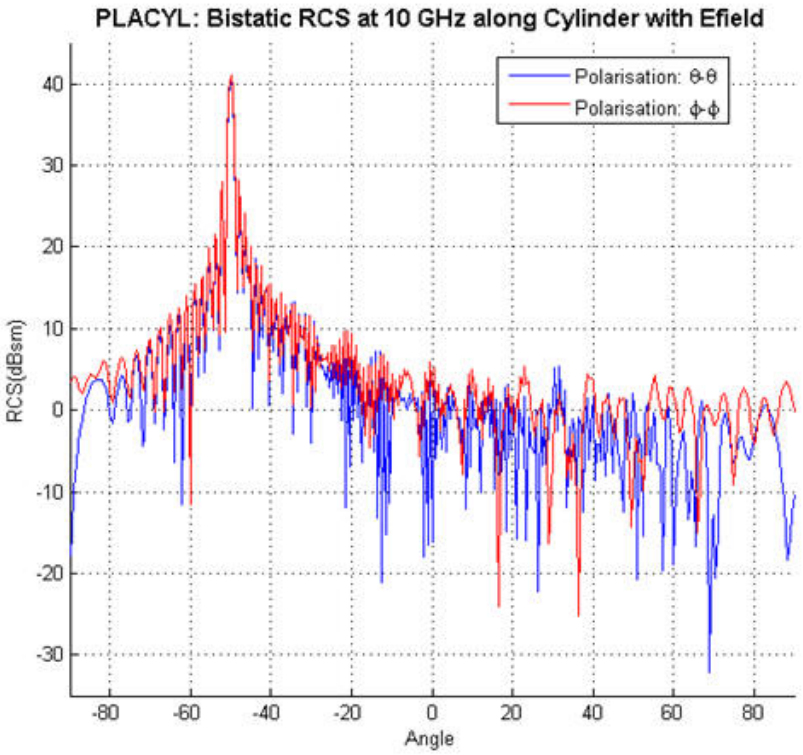

Figure 5: Bistatic RCS at 10GHz along cylinder

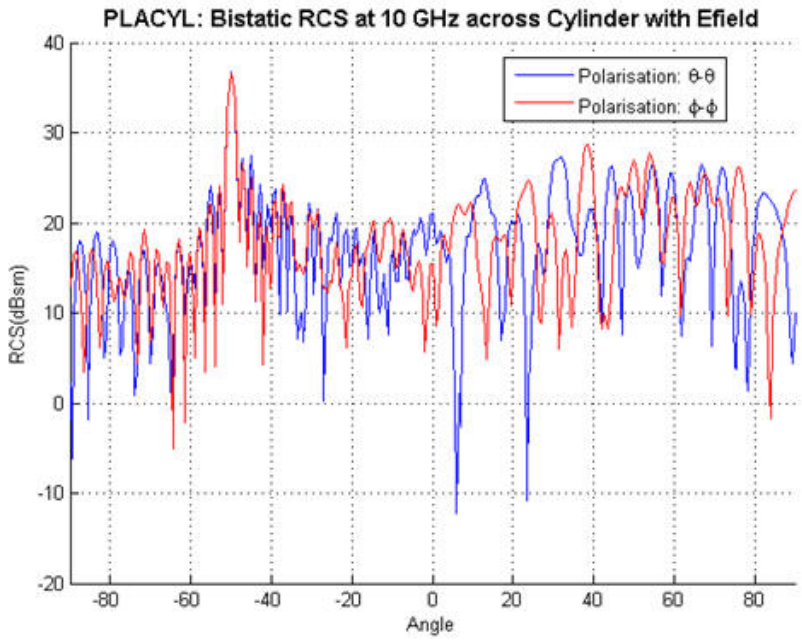

Figure 6: Bistatic RCS at 10GHz across cylinder

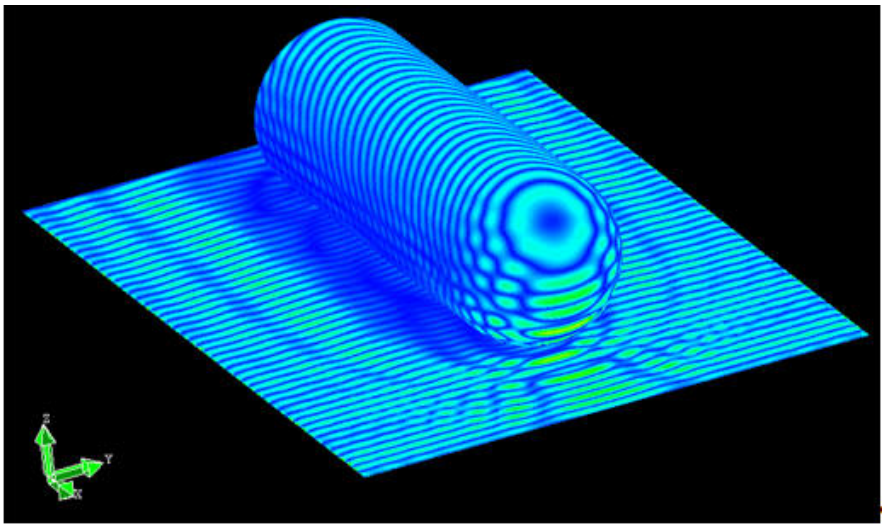

Figure 7: Surface currents at 5GHz

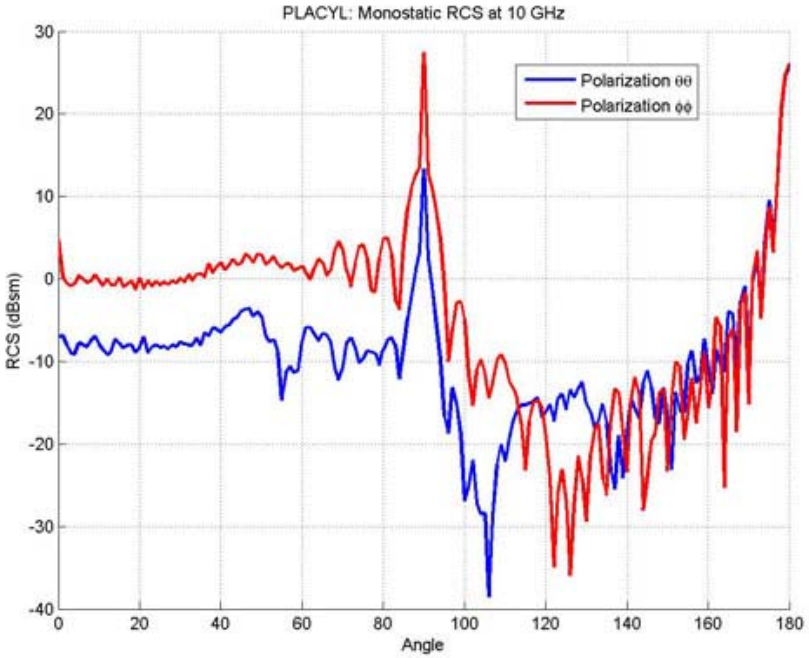

Figure 8: Monostatic RCS at 10GHz

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