Radar Cross Section Computation Using RAPPORT and the Method of Equivalent Currents, Results and Validation

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At the Physics and Electronics Laboratory a code has been developed for the analysis of radar signatures of complex objects. This code, "Radar signature Analysis and Prediction by Physical Optics and Ray Tracing" (RAPPORT), is used to predict the Radar Cross Section (RCS) of complicated objects like ships, vehicles and aircraft and to evaluate the effect of RCS reduction measures. The implemented algorithm is based upon a combination of Physical Optics (PO) and Geometrical Optics (GO), as proposed in [1]. Objects have to be described as a collection of flat polygonal plates, because of the adopted method to solve the PO integral [2]. RAPPORT makes use of an efficient backward ray-tracing algorithm to construct the illuminated part of the object, from which the RCS can be computed for any desired number of reflections and frequencies. The accuracy with which this illuminated area is determined can be controlled by a user defined parameter. This feature makes it possible to model very large complex objects like ships and it greatly facilitates the generation of inverse synthetic aperture radar (ISAR) images of the target. Since the first version [3], many new features have been added to the code, for instance improved ISAR capability, multipath computations and the use of non perfectly conducting materials.

In order to overcome the problems with edges that PO based codes encounter, a software tool based on the Method of Equivalent Currents [4] has also been developed at TNO [5]. With this program, called RCS_MEC, the scattering by sharp edges can be computed. To obtain a better representation of the RCS of a target, the scattered fields due to edge diffraction can subsequently be combined with the scattered fields due to reflection, as computed by RAPPORT. Especially when investigating low RCS targets edge diffraction plays an important role. RCS_MEC has the same computational capabilities as RAPPORT, with the exception of the use of dielectric materials. Objects have to be described as a collection of sharp edges with known wedge angles. A pre-processor has been made to extract these edges from the object description of RAPPORT, so both programs use the same object description. The advantage of this is clear, in case of RCS reduction by geometrical adjustments, only one file has to been changed.

During the presentation results will be shown, clarifying the capabilities of RAPPORT and RCS_MEC and the progress that has been made since the first version of the codes. Also validation results will be presented.

References

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