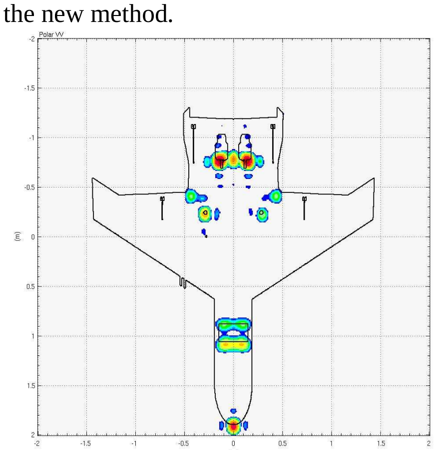
How to locate precisely and efficiently the scatterers of a target contributing to its RCS

J. Simon*, JC.Castelli
ONERA BP80100, 91123 Palaiseau FRANCE (www.onera.fr)

Radar imaging is an essential processing tool to perform a fine analysis of the interactions occurring in the RCS of a target. However, in some situations (low frequency, dispersive mechanism, etc.), the information obtained is limited or difficult to exploit. To obtain a useful radar image (in terms of location and resolution), it is necessary to measure or compute a multitude of frequencies and angles which depend on the length of the target and on the frequency and observation domain of analysis. Contrary to measurements which only have the total scattered field, the computations can trace the scattered field sources. Indeed, the scattered field is obtained by summing the contributions of each basic function. It is therefore possible to known and represent directly on the mesh the “unit RCS” of each basis function. Recently a low cost method based on the surface current density solution obtained from simulation data has been proposed to directly provide the scatterers participating in the Radar Cross Section (RCS) of a target (M.G. Aroujo et al., IEEE AP Mag., 2011). The image which is obtained is monochromatic by nature, the scatterers‘s location is on the target and is 3D by construction.

In this paper, the potential offered by this method are reviewed and are compared with radar imaging. The analysis is focused on the resolution of the images obtained by the two approaches, the fineness of the scatterers’s location and the restitution of complex interactions such as dispersive mechanism, creeping waves and multi-bounds which produce artefacts on images computed by radar imaging. Moreover, the construction of these images is extended to the case where the information on the surface current distribution is known for several illuminations frequencies and directions of observation. The figures below present the images of the scattering centers obtained by the two approaches in C-band and VV polarization on a generic UAV. The radar image (left) was calculated from 51 frequencies and 61 observation angles. The image obtained from the new approach (right) was constructed with the same number of angles and taking only the center frequency used to compute the radar image. Both images have the same dominant scattering centers but it can be noticed that the location is finer on the image obtained by the new method.



Radar Imaging Approach

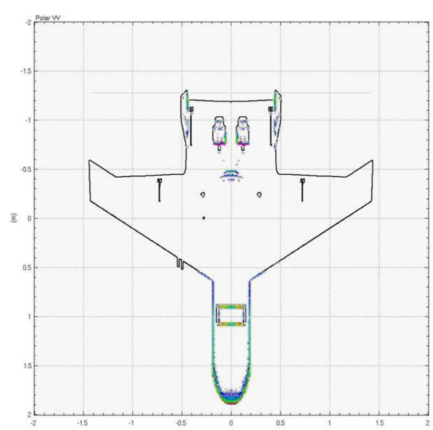


Image obtained from a surface current density solution