Design of a Stealthy Antenna Using COMSOL Multiphysics®

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Abstract

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In this paper will be shown some applications of COMSOL Multiphysics® to the analysis of Frequency Selective surface structures.
Introduction:
Frequency Selective Surfaces have been widely investigated to use as "spatial" filter in antennas applications. FSS are periodic structures consisting of electrically conductive elements on a dielectric substrate or complementary of non-conducting slot on an electrically conductive plane. The shape, dimensions and spatial distribution of the elements characterize the frequency dependent behavior of the structure.
The major characteristics of FSS is to be band-pass structures, so they can be employed as or with radome for antenna systems without affecting the required characteristics of the antenna in the operative frequency band.
The radar cross section (RCS) of a conventional antenna can be very large making it an easy target to pick up on basic radar systems. Stealthy antennas are designed to reduce the large RCS of conventional antennas. Several approaches can be used to make antennas stealthy one of these is to use FSS.
A frequency selective surface (FSS) can be part of the radome that protects the antenna[1] or integrated in the ground plane[2], in both cases the RCS reduction is achieved considering that the FSS are transparent at the operating frequency but rejects signals outside a band centered at the operating frequency.
This feature allows the antenna to low RCS for all frequencies outside the operative bandwidth.

Use of COMSOL Multiphysics®
In this paper, the attention will be focused on the application of FSS to antenna stealth technique. In particular, exploiting the band-pass behavior of the FSS , a design of a structure with a low RCS (Radar Cross Section) will be presented. The numerical analysis is performed with COMSol Multiphysics using PBC (periodic boundary condition) to reduce the computational effort required.
Results: The results of the FSS simulation will be shown in the final paper and presented at conference time.
Conclusion : The RF Module of COMSOL Multiphysics® has been applied to the simulation of FSS structures in order to design a stealthy antenna.

Reference

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3. L.-S. Ren, Y.-C. Jiao, et al ,”RCS reduction for a FSS-backed reflectarray using a ring element,” Progress In Electromagnetics Research Letters, Vol. 26, 115{123, 2011
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