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ULTRA WIDE BAND RCS OPTIMIZATION OF MULTILAYERED CYLINDRICAL STRUCTURES FOR ARBITRARILY POLARIZED INCIDENT PLANE WAVES

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Abstract—The addition theorems are applied to analyze the normal incidence of plane waves onto infinitely long conducting or dielectric circular cylinders with multilayer coatings made of common and uncommon materials $(\varepsilon_r, \mu_r, \sigma)$ with the objective of minimization and maximization of radar cross-section (RCS). TE, TM and circular polarizations of the incident wave are considered. Optimization of RCS by the method of least squares leads to the determination of layer thicknesses and the material complex permittivities and permeabilities. A sensitivity analysis of RCS with respect to the geometrical and material parameters of the multilayer coated conducting cylinder is also performed. It is observed that broadband reduction of RCS is mostly achievable by a combination of conventional materials $(\varepsilon_r,\ \mu_r > 1)$, and unconventional materials $(0 < \varepsilon_r,\ \mu_r < 1)$ and lossy materials $(\sigma > 0)$. It is seen that RCS reduction is due to the diversion and dissipation of radar signals. The results agree very well with the experimental and theoretical data available in the literature.

1. INTRODUCTION

Radar systems have wide civilian and military applications, such as remote sensing, meteorology, medicine, radio wave propagation, surveillance, etc. The radar cross-section (RCS) of an object is a complicated function of observation angle, signal frequency and polarization, material and dimensions of the object. RCS may be determined by experimental measurement, but such a procedure may not be practical and applicable for all angles of observation and any object dimensions. Therefore, numerical electromagnetic techniques are required for the computation of RCS. The frequency spectrum