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An Efficient Algorithm for Multiple Scatterers: A Semi-Analytic Approach

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The investigation undertaken in this work extends the applicability of the Method of Analytical Regularization (MAR) described in [1], which was applied to the analysis of 2D potential problems for multi-conductor systems and multiple electromagnetic wave scattering by ensembles of arbitrary solid perfectly conducting cylinders [2, 3]. The rigorous theory developed here concerns the multiple scattering from perfectly electrically conducting, infinitely long cylindrical cavities of arbitrary cross section and with longitudinal slits. The solution so obtained is also valid when the slit widths of some or all of the cavities tend to zero, thus becoming closed cavities. There are no restrictions on the number of cavities, slit widths or their relative locations. From the numerous available combinations of open and closed cavities, a selection to illustrate the resonance responses of various different systems of coupled resonators illuminated by an obliquely incident *E*-polarized plane wave is made. The basic profiles of the open cavities are drawn from circular, elliptic and rectangular cross sections and in addition, flanged rectangular cavities are considered. We investigate linear arrays of such cavities and more complicated configurations.

Initially, we accurately calculate the first few lowest complex eigenvalues for single slotted cavities. Then we study the perturbation or shift in these eigenvalues for various configurations parametrised by distance between cavities and by slit widths. When the imaginary part of the complex eigenvalue exhibits a dramatic drop in magnitude (compared with the corresponding value for a single resonator) there is “strong coupling”, whereas when these values insignificantly differ from each other (if, for example, the resonators are well spaced from each other) “weak coupling” pertains.

With this data in mind, we calculate the frequency dependence of the *monostatic radar cross-section*, accomplished by computation of the bi-static far-field.

References

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