Electromagnetic Scattering Analysis Using a Model of Dipoles Located in Complex Space

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***Abstract*—Fictitious current-models have been applied extensively in recent years to a variety of time-harmonic electromagnetic wave scattering problems. This paper is introducing an extension of the current-model technique which facilitates the solution to problems subsuming metallic scatterers whose periphery contains a variety of length-scales features. This extension is in tune with the current-model technique philosophy of using simple current sources the fields of which are analytically derivable. It amounts to letting the coordinates of part of the source centers assume complex values. Positioned in complex space, the simple current sources radiate beam-type fields which are more localized and are better approximations of the scattering by the smooth expanses of the structure. The coordinates of the other source centers can retain their conventional real values or have only a relatively small imaginary constituent. These latter current sources are used to approximate the fields in the vicinity of the more rapidly varying regions of the structure. The new approach is applied to analyze electromagnetic scattering by a perfectly conducting oblate spheroid. It is found to render the solution computationally more effective at the expense of only a slight increase in its complexity.**

solutions discussed in [4] these sources are multipoles centered at multiple origins. In some other current-model solutions there have been preferences for other sources. Specifically, in the case of periodic structures, spatially-diffused sources with analytically derivable fields have been used [5], [6].

This paper takes a step forward in extending the current-model technique to handle problems of electromagnetic scattering by objects that contain a variety of length-scales ranging from a subwavelength to several wavelengths. To solve problems of this kind, one can of course combine the current-model technique with other numerical and asymptotic methods to form a hybrid method which possesses the required flexibility. In such a hybrid method, the effect of the rapidly changing small-scale features can be accounted for by using the current-model technique, while the smoothly varying large-scale features can be analyzed by a high-frequency asymptotic technique such as the geometrical theory of diffraction. However, in this paper we further investigate the more promising