Incremental Double Diffraction Coefficients for Complex Source Points

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Efficient techniques for representing the field radiated by a given feed antenna or feed array (L. B. Felsen, "Complex source point solution of the field equations and their relation to the propagation and scattering of Gaussian Beams," *Symposia Mathematica*, vol. 18, pp. 39-56, 1976), (K. Tap, "Complex Source Point Beam Expansions for Some Electromagnetic Radiation and Scattering Problems", Thesis Dissertation, Ohio State University, 2007) are based on the field expansion by Complex Source Point (CSP) basis functions. A fast beam expansion technique can be successfully used to analyze with efficiency the radiation or the scattering from complex geometries, when illuminated by a complex feed antenna. The electromagnetic field radiated by an aperture antenna is represented by a set of CSPs: each contribution's EM beam reaches the complex object where it undergoes both a reflection and a diffraction by the surface and the edges, respectively. Recently a new methodology has been introduced to determine the ITD diffracted field when in GO operating conditions (A. Polemi, G. Carluccio, M. Albani, A. Toccafondi and S. Maci, "Incremental theory of diffraction for complex point source illumination," *Radio Science*, vol. 42:RS6S23, pp. 1-13, 2007) or the incremental fringe correction term to improve the PO scattered field (S. M. Canta, D. Erricolo, A. Toccafondi, "Incremental Fringe Formulation for the Scattering of a Complex Point Source Beam Expansion by Planar Metallic Objects", 2009 IEEE AP-S/URSI Conference, June 01-05, 2009, Charleston, SC, USA). Using CSPs as basis functions allows for fast truncation of non-necessary contributions and the ITD/IFF formulations smoothly recover the ray field description and satisfy reciprocity. However, for configurations in which several metallic edges are present, we require a better analysis for which Incremental Double Diffraction coefficients help in determining the correct interactions between the edges in the problem, whether they are located on a same plane or they are skewed with respect to each other. The new contribution is the determination of the Double Diffraction coefficients for the case of CSP illumination. We will determine incremental coefficients similar to their real counterparts, where the relevant complex quantities will be derived by analytical continuation (A. Toccafondi and R. Tiberio, "An incremental theory of double edge diffraction, *Radio Sci.*, vol. 42, RS6S30, doi:10.1029/2007RS003681). The formulation provides an asymptotic description of the interaction between two edges, which is valid both for skewed separate wedges and for edges joined by a common PEC face. It also includes a double incremental slope diffraction augmentation, which provides the correct dominant high-frequency incremental contribution at grazing aspect of incidence and observation. This formulation is obtained by applying to both edges the wedge shaped incremental dyadic diffraction coefficients for single edge diffraction. The total doubly diffracted field is obtained from a double spatial integration along each of the two edges on which consecutive diffractions occur.