Extended Discrete Sources Method Model for Extremal Scatterers

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Light scattering analysis used in nanotechnology and biophotonics has been a subject of interest in last decades. This is primarily due to the variety of practical applications it is encountered in, for example, aerosol analysis, investigation of air pollution, radio wave propagation in the presence of atmospheric hydrometers, weather radar problems, analysis of contaminating particles on the surface of silicon wafers, remote sensing, etc. Special attention has been paid to extremely shaped particle light scattering problems. Methods being implemented to solve such problems are usually expensive in computer resources, especially if the size of the scattering object relative to the wavelength of the incident radiation is big. Another problem arises if scattering body is asymmetrical. In this case one has to implement more sophisticated methods than he might have been able to use in case of axis-symmetrical obstacle. So advanced methods are constantly developed to solve these both problems mentioned above. We introduce here a new approach which allows one to reach these goals.

Light scattering by extremely shaped local obstacle is considered here. The model used here is based on symmetrical version of the Discrete Sources Method (DSM) [1]. This technique constructs the scattered field everywhere outside a local obstacle as a finite linear combination of the fields resulting from electric and magnetic multipoles distributed over an auxiliary segment of the obstacle's axis of revolution inside the obstacle. Then the scattered field analytically satisfies transmission conditions at the obstacle's surface. Internal field is represented on the basis of regular functions, which fit Maxwell's equations [2]. So, the DSM solution constructed satisfies Maxwell's equations everywhere outside the obstacle, required infinity conditions and transmission conditions at the obstacle's surface. Then the unknown DS sources amplitudes are to be determined from boundary conditions enforced at the surface of the local obstacle.

It has been found that more stable results can be obtained by using pseudo-solution of an over-determined system of linear equations obtained by following the generalised point-matching technique. Select a set of matching points on the particle homogeneously covering the surface. Then distribute homogeneously DS over the auxiliary segment of scatterer's axis of revolution. In each DS point we choose three independent electric multipoles and three independent magnetic mutipoles, which originate the scattered field. Then the linear system to be used for determining of the DS amplitudes is derived from matching the boundary conditions at the set of matching points. This procedure leads to an over-determined matrix and the DS amplitudes are evaluated by a pseudo-inversion technique [3]. The numerical scheme allows one to consider all incidences and both polarization P and S at once. DSM computer model controls convergence and stability of the result obtained by a posterior evaluation of the surface residual. In the presentation computer simulating results associated with an influence of obstacle's aspect ratio, orientation and exciting field polarization on the scattering spectra will be presented.

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