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Analysis of the Scattered Fields by Dielectric Sphere Inside Different Dielectric Mediums: The Case of the Source and Observation Point Is Reciprocal

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Abstract : The electromagnetic scattering from a canonical structure is an important issue in electromagnetic theory. In this study, the electromagnetic scattering from a dielectric sphere with oblique incidence is investigated. The incident field is considered as a plane wave with H polarized. The scattered and transmitted field expressions with unknown coefficients are written. The unknown coefficients are obtained by using exact boundary conditions. Then, the sphere is considered as having frequency dependent dielectric permittivity. The frequency dependence is shown by Cole-Cole model. The far scattered field expressions are found respect to different incidence angles in the 1-8 GHz frequency range. The observation point is the angular distance of pi from an incident wave. While an incident wave comes with a certain angle, observation point turns from 0 to 360 degrees. According to this, scattered field amplitude is maximum at the location of the incident wave, scattered field amplitude is minimum at the across incident wave. Also, the scattered fields are plotted versus frequency to show frequency-dependence explicitly. Graphics are shown for some incident angles compared with the Harrington's solution. Thus, the results are obtained faster and more reliable with reciprocal rotation. It is expected that when there is another sphere with different properties in the outer sphere, the presence and location of the sphere will be detected faster. In addition, this study leads to use for biomedical applications in the future.

Keywords : scattering, dielectric sphere, oblique incidence, reciprocal rotation
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