Computer Program Descriptions

Mie Series Solution for a Sphere

PURPOSE: To compute the Mie series solution for plane-wave scattering by a conducting sphere and by a homogeneous loss-free material sphere.

LANGUAGE: Fortran IV (IBM).

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AVAILABILITY: The program and documentation are available as ASIS-NAPS Document No. NAPS-03266. Also available while the supply lasts as Technical Report TR-77-12, ECE Dept., Syracuse University. Card decks may be obtained from the author for a cost of $20.00.

DESCRIPTION: The computer program calculates the solutions to two problems, that of a perfectly conducting sphere excited by an incident plane wave and that of a loss-free homogeneous material sphere excited by an incident plane wave. The theory is contained in [1]. The notation is the same as in [1].

This computer program consists of eight subroutines and a main program. The first two subroutines, BES and LEG, calculate spherical Bessel functions and Legendre polynomials, respectively. The next three subroutines, CURNTC, PATRNC, and CURPTC, are for the conducting sphere. CURNTC calculates the electric current induced on the surface of the conducting sphere, PATRNC calculates the two principal plane scattering patterns for the conducting sphere, and CURPTC calculates both the electric current and scattering patterns. The last three subroutines, CURNTD, PATRND, and CURPTD, are for the material sphere. CURNTD calculates the equivalent electric and magnetic currents on the surface of the material sphere, PATRND calculates the scattering patterns for the material sphere, and CURPTD calculates both the equivalent electric and magnetic currents and the scattering patterns. The main program obtains sample output from the last six subroutines.

The sample output for the perfectly conducting sphere is for $ka=3$, where k is the propagation constant and a is the radius of the sphere. The sample output for the material sphere is for the dielectric sphere with $k_0a=3$ and $\epsilon_r=4$, where k_0 is the propagation constant in the external medium, a is the radius of the sphere, and ϵ_r is the permittivity of the sphere relative to the permittivity of the external medium. The sample output for the material sphere is plotted in Figs. 8–11 of [2].

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References

[1] R. F. Harrington, *Time Harmonic Electromagnetic Fields.* New York: McGraw-Hill, 1961, Section 6–9.

[2] J. R. Mautz and R. F. Harrington, "Electromagnetic scattering from a homogeneous body of revolution," Technical Report TR-77-10, Department of Electrical and Computer Engineering, Syracuse University, Syracuse, NY 13210, Nov. 1977.