NEW REGIME MAP OF THE GEOMETRIC OPTICS APPROXIMATION FOR SCATTERING FROM RANDOM ROUGH SURFACES

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ABSTRACT. The electromagnetic wave scattering from random roughness surfaces is a technologically important but challenging problem. There is a significant amount of interest in understanding the radiative properties of the rough surfaces for diverse applications. On one end, the rigorous models require the solutions of complex formulations of the Maxwell's equations or rely on various numerical schemes, which typically are computationally intensive. On the other hand, it has been found that the geometric optics ray tracing approximation method produces reasonably accurate radiative property predictions in some cases and with little computational effort. However, the latter ignores the wave interference and polarization effects, which are important when the wavelength is on the same order or larger than the geometrical length scale. It is therefore important to quantify the accuracy of the geometric optics approximation. This study reports a new regime map based on the comparisons of the geometric optics and finite-difference time-domain solutions.