Abstracts

Coupling Between Guided Surface Waves, Lateral Waves, and the Radiation Fields by Rough Surfaces--Full-Wave Solutions

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In this paper explicit expressions are presented for the guided surface waves and lateral waves that are excited when radiation fields are incident upon rough surfaces. Similarly, expressions are presented for the radiation fields scattered by rough surfaces that are excited by surface waves and lateral waves. In addition, coupling between the surface waves and the lateral waves due to surface irregularities is considered in detail. The solutions, which are based on a full-wave approach to the problem, are subject to the exact boundary conditions at the irregular interface. These are shown to be consistent with the reciprocity relationship in electromagnetic theory. The validity of the approximate impedance boundary condition is examined and consideration is given to excitation at the grazing incidence, the Brewster angle, and to waves incident at the critical angle for total internal reflection. Optimum conditions are determined for coupling between the radiation fields, the surface waves, and the lateral waves incident upon irregular boundaries. Thus this work is applicable to problems of radio wave propagation near an irregular interface between two media and excitation of guided waves by irregular dielectric structures.

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