SCATTERING FROM SINUSOIDAL SURFACES OF SMALL PERIOD

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Scattering from conducting surfaces having a sinusoidal height profile is a topic that has seen a significant degree of activity. While such surfaces are not abundant in nature, they do provide the opportunity to understand some basic scattering properties of a special class of periodic surfaces. Most of the research that has appeared in the literature reltive to this problem has been analytical in nature. The purpose of this paper is to investigate the usefulness of numerical techniques for a specific topic that has no known solution. It is well known that if a sinusoidal surface has a very large period relative to the electromagnetic wavelength of the incident radiation, the Kirchhoff approximation does a reasonable job of predicting the current induced on the surface except when a Bragg order of the scattered field exits the surface at grazing. Conversely, when the height of the surface is amall compared to a wavelength, perturbation does a reasonable job of predicting the scattering assuming the surface has a period that is not too different from that of the incident radiation. However, when the height of the surface is the order of the electromagnetic wavelength and the wavelength of the surface is smaller than the wavelength of the incident radiation, there is little data available to determine just how the current is behaving in this instance. It is very important to understand just exactly how the surface current behaves as the wavelength of the surface becomes mush smaller than that of the incicent radiation. It is clear that eventually the current will eventually only ”see” the crests or tops of the sinusoidal surface and this surface will behave as a flat surface in its scattering properties. In this paper, we apply the Method of Ordered Multiple Interaction (MOMI) to compute the current induced on the surface. We use the results to compute the far zone radiation pattern and the field very near to the surface for the purpose estimating when the sinusoidal surface behaves as a planar surface in its scattering properties. We also show how the current on the small wavelength surface starts to act like the planar surface current. All of the studies are carried out a normal incidence.

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