163
标题: Use of Generalized Sheet Transition Conditions to Model Guided Waves on Metasurfaces/Metafilms
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摘要: We use generalized sheet transition conditions (GSTCs) to investigate the existence of guided waves (both surface waves and complex modes) on a metafilm: a surface distribution of electrically small scatterers characterized by electric and magnetic surface susceptibilities. In this paper, excitation of a metafilm by both electric and magnetic line currents is investigated. The characteristics of the guided waves for both these polarizations are expressed in terms of the surface susceptibilities, which are directly related to the electric and magnetic polarizabilities of the scatterers composing the surface. We will show that the guided waves can have unique behaviors (not found in classical slab configurations) for judicious choices of the scatterers in the metafilm. For example, unlike a conventional dielectric slab, forward and backward surface waves as well as complex modes can be excited simultaneously on the metafilm, a direct consequence of engineering the properties of the constituent scatterers. Two different classes of modes (even and odd) are possible on the metasurface. The odd mode is analogous to the surface plasmon polariton seen on some metamaterials, and under certain conditions, the even mode is analogous to the classical dielectric slab surface wave. In order to validate the predictions presented here, we present numerical results for an electric-line source placed above a metafilm composed of spherical particles. We also show comparisons of propagation constants obtained from our model to other analytical results found in the literature. Finally, we show that the results from our formulation reduce to analytical results given in the literature for a thin dielectric layer.
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