Abstracts

Guided-Wave Theory of Light Diffraction by Acoustic Microwaves (Nov. 1969 [T-MTT])

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The diffraction of a plane light wave incident obliquely upon an isotropic dielectric layer traversed longitudinally by an acoustic microwave is examined by means of a guided-wave approach. In addition to a considerable amount of physical insight, this approach provides a wide range of techniques that have already been developed extensively in the area of electromagnetic microwaves. As a consequence, available methods can be used to explain and express known aspects of the diffracted light in terms of simple guided-wave concepts which are applied herein to derive results that have not been available. It is shown that the difracted field within the dielectric layer, as well as in the exterior (air) medium, can be described by means of two alternative modal representations: 1) a description in terms of characteristic modes which progress independently of each other, and 2) a description in terms of coupled modes which interact with each other in the presence of the acoustic wave. While the two representations are equivalent, each has its own advantages and both are discussed in detail. It is also shown that these representations lead to equivalent networks that may be utilized to account for boundary conditions and for other features of the scattered field. In particular, diffraction phenomena in a Bragg regime are carefully investigated; qualitative and quantitative results are presented for situations wherein the orientation of the optic-acoustic interaction occurs at a Bragg angle of arbitrary order.

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