Abstracts

Iterative Numerical Computation of the Electromagnetic Fields Inside Weakly Nonlinear Infinite Dielectric Cylinders of Arbitrary Cross Sections Using the Distorted-Wave Born Approximation

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The electromagnetic scattering by weakly nonlinear infinite dielectric cylinders is the topic dealt with in this paper. The cylinders are assumed to be isotropic, inhomogeneous, and lossless and to have arbitrarily shaped cross sections. A time-periodic illumination of the transverse magnetic type is considered. The nonlinearity is assumed to be expressed by the dependence of the dielectric permittivity on the internal electric field, under the hypothesis that the operator responsible for the nonlinearity does not modify the scalar nature of the dielectric permittivity and produces a time-periodic output. The electromagnetic scattering is then described by an integral equation formulation, and the electromagnetic field distributions inside and outside a scatterer are approximated by an iterative numerical procedure starting with the application of the distorted-wave Born approximation. In a simplified version of the approach, the classic first-order Born approximation is used. The convergence of the approach is discussed in several examples. In the computer simulations concerning cylinders with different cross-section shapes, the effects of the nonlinearity on the field-component fundamental frequency were evaluated for different values of the nonlinear parameters in the case of a Kerr-like nonlinearity and of a uniform incident plane wave. The generation of higher-order harmonics was also considered.

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