Time-harmonic electromagnetic waves in nonlinear media:
recent mathematical problems and results.

Jarosław Mederski

IMPAN

Abstract

The propagation of time-harmonic electromagnetic waves is governed by Maxwell's equations for the electric and magnetic field. In nonlinear media with constitutive relations, the system is reduced to the electromagnetic wave equation which is very difficult to solve and usually in the literature one can find different approximations, e.g. the most prominent one called the slowly varying envelope approximation, where the propagation of waves are studied by means of solutions of Schrödinger equations. However, according to recent nonlinear optics literature, such solutions may have no valid physical properties and one needs to find the exact propagation of the electromagnetic waves. In the talk we present recent results on the topic and describe the available analytical methods for finding exact solutions of the electromagnetic wave equation. Moreover some open problems will be discussed as well.