Modelling of non-linear nanophotonic devices

(invited)

P. Bienstman , **B. Maes, P. Vandersteegen, R. Baets**

Ghent University, Department of Information Technology, Ghent, Belgium
Peter.Bienstman@UGent.be

We present several frequency domain methods for modelling non-linear phenomena.

First, we will discuss modelling of Kerr non-linear devices, based on an iterative extension of the eigenmode expansion method [1]. After introducing the basic principles of the method and its advantages, a number of examples will be presented, ranging from photonic crystals switches to self-induced waveguides in photonic crystals. For the latter, another approximate model based on strip Green functions will also be introduced.

Secondly, we will present another extension of the eigenmode expansion method which allows one to study second harmonic generation [2]. It is based on the inclusion of extra generating terms in the scattering matrix formalism. The calculation can be either single-pass in the absence of pump depletion, or iterative when pump depletion is taken into account.

Finally, a different method of simulating Kerr devices will be discussed [3], which is based on an extension of Hadley's complex Jacobi iteration method. As Hadley's method is already iterative in its original, linear form, it is naturally suited to incorporate Kerr non-linear effects.

References

[1] Maes *et al., JOSA B,* pp. 613 (2005*).*
[2] Maes *et al., OWTNM04, Ghent* (2004*).*
[3] Vandersteegen *et al., OWTNM05a, Grenobl,* (2005*).*

Photonic Crystals: Fundamentals to Devices

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