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Vector wave equation expansion method for leaky modes in microstructured optical fibres.

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Abstract:

Microstructured Optical Fibres (MOF) have been found to exhibit numerous unique properties of practical importance, particularly that of single modedness over a wide range of wavelengths or core sizes. A central issue to understanding such behaviour is the confinement losses associated with the modes supported by these waveguides.

Unlike the truly bound modes of conventional fibres, the modes of MOFs are leaky. Physically, the light is trapped by an enclosure of air holes and confinement loss arises from energy leakage between and through the holes. Computationally, leakage is modelled using complex effective mode indices and unbound mode field distributions.

A new method for calculating leaky modes from the vector wave equation is presented. Modifications to the expansions used in existing Galerkin (expansion) techniques have enabled leakage to be calculated by applying non-reflecting, impedance matched boundary conditions. The method has the simplicity and speed of a Galerkin method, while being unrestricted to holes of a particular shape. Thus it provides a powerful tool for MOF design. Results of the method applied to typical structures will be presented and discussed.