CHAPTER 55

TECHNOLOGY
APPLIED PHYSICS

Doctoral Theses

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Numerical and Analytical Studies of Photonic Crystals and Devices.
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Abstract

Studies the example of a highly lperiodic cladding structure (conventional photonic crystal fiber) surrounding a solid glass core of a photonic crystal fibre and describes the fundamental waveguiding properties e.g. cut off properties, high numerical aperture, inquisitive dispersion properities (e.g. (i) zero dispersion at any wavelength (ii) nearly zero flattened dispersion and (iii) high negative dispersion), spectral response of bend loss, splice loss between similar PCFs due to transverse and angular misalignment etc. by means of full vectorial effective index method over scalar effective index method. Moving towards a modified srtucture, the size of air holes near the core has been amended to realize more flattened dispersion using revised full vectorial effective index method. Also to study the Birefringent behavior of the elliptical core photonic crystal fiber, a combined approach, FVEIM with higher order Mathieu functions, has been proposed. Proposes the hybrid design of PCF in which not only cladding but also core consist air holes and yields the ultrahigh birefringent with ultra low confinement loss by means of finite element method. photonic crystal waveguide i.e. nonlinear wave propagation through photonic crystal fiber has been studied by full vectorial effective index model with modified core radius for different design parameters. Enhanced effects of Superprism is very useful for number of applications including new devices for Dense wavelength-division- multiplesed to integrated optical circuits for beam manipulation. Spectral separation and beam steering properties can be strongly controlled using single

Superprism device rather than the larger system composed of other devices.

Contents

1. Introduction. 2. Propagation characteristics of photonic crystal fibres: Scalar effective index method & full vectorial effective index method . 3. Modeling and design of double clad photonic crystal fibre 4. Study of birefringence of elliptical core PCF using mathieu function. 5. Ultrahigh birefringent photonic crystal fiber with low confinement loss. 6. Nonlinear properties of photonic crystal fibre. 7. Photonic crystal as superprism. 8. Summary and future scope of the work. Bibliography.