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Title: Single non-degenerate mode propagation in air-core Bragg fibres.

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Abstract:

Whilst many designs for Bragg fibres have appeared in the literature the realisation of such designs is limited by the available fabrication techniques, which are in turn mostly limited to low refractive index contrasts. We present a method for producing holey fibres, where circular rings of holes are used to define the refractive index profile of the structure. We present experimental results from such fibres and verify that the holey structures fabricated behave like the circularly symmetric concentric ring structures that are required. Whilst such fabrication techniques could be used to produce a large variety of circularly symmetric refractive index profiles, we concentrate on Bragg fibres and outline a novel technique for mode suppression that results in air-core Bragg fibres that guide a single polarisation non-degenerate mode. Unlike other designs for single-mode Bragg fibres we show that this design method ensures true single-modedness for practical lengths of fibre. We derive the restrictions the design method places on the parameters of the fibre, such as material and core size, and show that rings of holes are an ideal way of producing these fibres. In practice, these fibres would eliminate problems associated with polarisation such as polarisation mode dispersion and polarisation fading in interferometry whilst minimising problems associated with existing polarising fibres such as alignment issues arising from a lack of circular symmetry. Guidance in air would minimise problems of material loss and dispersion and undesired nonlinearities.