Design and simulation of the circular photonic crystal fibers for guiding and controlling of orbital angular momentum of light

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Abstract

In this paper, we designed and simulated the circular photonic crystal fibers (C-PCFs) for guiding and controlling the orbital angular momentum (OAM) of light. The optimum parameters in C-PCFs were archived by considering the conditions that eliminate the spin-orbit coupling for each guided mode. Moreover, for optical communication applications, a flat modal dispersion is required for a wide wavelength range from 1.25 to 2 μm and the OAM modes must have a low confinement loss. For different fractions of air filling (*f*), the results were simulated and compared to achieve the best values of *f*. According the simulated results, the proposed design of C-PCF can support a group of OAM modes up to HE_{51} and EH_{31} with topological charge of $l=4$. Furthermore, our C-PCF shows high quality in terms of dispersion and OAM mode losses, which can additionally be used in space-division multiplexing rather than the conventional wavelength-division multiplexing for optical communication systems.

Keywords: Orbital angular momentum, Circular photonic crystal fibers, Dispersion, Confinement loss

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