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Contents

Original Article

Fiber-based mode converter for generating optical vortex beams 180003

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A novel orbital angular momentum (OAM) mode converter is proposed, which is easy to be fabricated with the existing optical-fiber drawing techniques. We design and simulate an all-fiber based OAM mode converter composed by cascading a mode selective coupler (MSC) and an inner elliptical cladding fiber (IECF). The OAM modes refer to a combination of two orthogonal LP_{lm} modes with $\pm\pi/2$ phase difference. The MSC is used to generate the LP_{lm} modes, where l denotes the azimuthal index and m represents the radial index which is assumed as 1, then the IECF can introduce $\pm\pi/2$ phase difference between two degenerate orthogonal modes after a certain propagation length. By adjusting the parameters and controlling the splicing angle of MSC and IECF appropriately, the higher-order OAM modes with topological charges of l = ±1, ±2, ±3, … can be obtained with fundamental mode LP_{01} injection, featuring a mode conversion efficiency of almost 100%. This method may pave the way towards the potential application as a compact, all-fiber and high-efficiency device for increasing transmission capacity and spectral efficiency in optical communication systems with OAM modes multiplexing.

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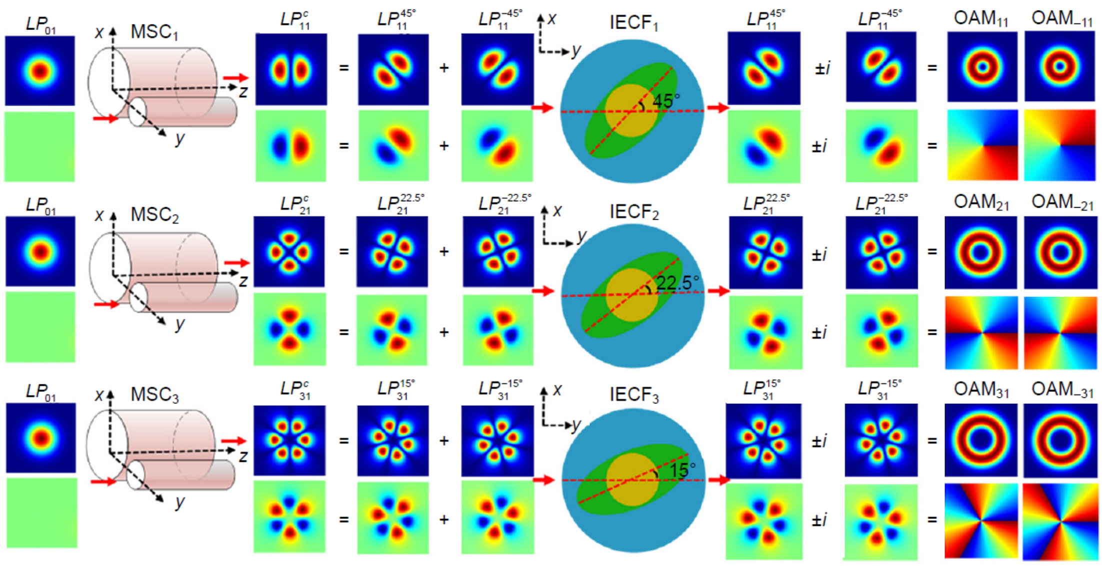

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Original Article

An accurate design of graphene oxide ultrathin flat lens based on Rayleigh-Sommerfeld theory 180012

Guiyuan Cao, Xiaosong Gan, Han Lin and Baohua Jia

Ultrathin flat lenses with three-dimensional subwavelength focusing capability have been urgently demanded with the rapid development of nanooptics and on-chip photonic systems. The lack of accurate theoretical design tool prevents the ultrathin flat lenses from achieving the expected high performance. Current theoretical design tools based on the Fresnel approximation, which is not able to accurately describe the focusing and imaging process of ultrathin flat lenses. This work develops a method based on the Rayleigh-Sommerfeld diffraction theory without the paraxial constrain to design ultrathin flat lenses, which is able to accurately design flat lenses with arbitrary focal length, diameter, and numerical aperture. The design is directly decided from the Rayleigh-Sommerfeld diffraction theory without optimization process. The paper first presents a detailed derivation process of the theoretical method and examples of lens designs. In addition, the experimental fabrication and characterization of graphene oxide lenses based on the designs are demonstrated to compare with the theoretical results. Excellent agreement among the theoretical model, the FDTD simulation and the experimental results are shown. In the meantime, the deviation from the tradition Fresnel design method is discussed. The difference between the two design methods is particularly significant in high NA lenses, in which Fresnel method fails to provide fidelity. This work provides a theoretical tool to accurately design ultrathin flat lenses of arbitrary materials given the NA and focal length requirements, in particular, high NA flat lenses, including metasurface or other two-dimensional materials.

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