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Multi-Core Fiber Creates Optical Supermode for Larger Effective Area

Bundled cores use crosstalk to act as a larger core with unique properties

Introduction

To increase capacity for optical communication systems, this technology increases the effective area of fiber modes to decrease the limitation of Kerr nonlinearity by using multi-core fiber (CMCF) structure. The new structural innovation takes advantage of the crosstalk between the cores of a conventional multi-core fiber. Instead of avoiding crosstalk, the CMCF is able to use it for enhanced data transmission by shortening the core-to-core distance compared to conventional multi-core fiber. Optical energy that extends beyond the boundaries, evanescent fields, can easily couple into adjacent fiber cores. As the set of cores is coupled, it acts as a larger core and allows data transfer over increased bandwidth.

Offering higher mode density and larger mode effective area than conventional multi-core fiber, the new fiber design can also prevent the mode coupling of supermodes, with design freedom including core-to-pitch ratio and core arrangement. Simulation results have shown lower modal dependent loss, mode coupling, and differential modal group delay compared to few-mode fiber, making the new coupled multi-core fiber design a candidate for spatial division multiplexing and single-mode operation.

Technical Details

According to Xia (2011), for single-mode operation, CMCFs can attain larger effective index difference (Δn_{eff}) and effective area (A_{eff}) than FMFs. As a result, CMCFs tend to have less mode coupling and nonlinearity, which is important for efficient long-haul transmission. This invention is a passive, coupled multi-core fiber wherein the cores each support a spatial mode and are positioned close enough to cause coupling between their modes, generating supermodes capable of transmitting data.

UCF Inventors

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Inventor Publication

Xia, C., Bai, N., Ozdur, I., Zhou X., & Li G. (2011). Supermodes for optical transmission. *Optics Express*, 19, 16653-16664



Benefits

- Increased transmission capacity

Applications

- Optical communication systems

Tech Fields

Communications

Keywords

fiber optics, optical communication systems

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