Simplified Processing for Space-Multiplexed Optical Signals

Optical communication systems using multi-core fibers enable the high-bandwidth advantages of space-multiplexed systems. However, the lack of a practical photonic signal processing technique has limited its use. Most current optical signal processing components designed for an on-axis incoming beam can’t be applied to a multi-core fiber because the beams from a multi-core fiber are both on-axis and off-axis. Alternatively, previous methods required that system components be multiplied by the number of signals transmitted. This new processing method is comparatively simple, uses only one pair of single lenses, and doesn’t require complicated alignment or calibration.

Technical Details
This technique provides the additional degrees of freedom needed for spatial multiplexing by exploiting the parallelism in bulk optics. In this technique, the facet of an input fiber is mapped or imaged to the facet of an output fiber after passing through a region where light associated with all signals travels in pre-designed directions. Off-axis beams from an input fiber can be tilted by an angled facet on the output end of the input fiber; a central facet, perpendicular to an optical axis of the system and an outer facet that extends either forward or backward from the central facet; a wedge prism; or a tapered input fiber with a frustoconical end. Tilting the beams as such and crossing them from the focal point of a single lens can make them parallel to the optical axis, enabling multi-core fiber optical system processing.

An optical system including this new technique can operate as a band pass filter, a polarization sensitive or polarization insensitive optical isolator, an optical switch, or an optical cross-connect. The processing technique can be applied to multi-core broadcast and distribution optical networks and multi-core, multi-access networks.

UCF Inventors
Guifang Li, Ph.D.; Ibrahim T. Ozdur, Ph.D.

Benefits
• Uses one pair of single lenses
• No complicated alignment or calibration needed

Applications
• Space-multiplexed optical transmission systems

Tech Fields
Optics & Lasers

Keywords
space-multiplexed, signal processing, multi-core fibers, multimode fibers, band pass filter, optical isolator, optical switch, optical cross-connect

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