In optical communications, spectral efficiency can be increased by simultaneously transmitting signals in both transverse-magnetic (TM) and transverse-electric (TE) polarizations, and receiving the signal by polarization-division multiplexing (PDM). Conventional (PDM) requires knowledge of the original modulation format before the signal can be successfully demultiplexed. Blind demultiplexing approaches are preferred for their PDM ability without knowledge of training data from the signal source. Using the constant modulus algorithm (CMA) is the leading approach among currently available technology, but falls short compared to independent component analysis (ICA), primarily because of its less-effective handling of non-constant modulus formats and by allowing for the chance that two outputs of CMA converge to the same polarization, defeating the purpose of demultiplexing. Multiple-input multiple-output (MIMO) optical communication employing polarization multiplexing, spatial mode multiplexing, multi-fiber multiplexing, and combinations of these approaches can all benefit from ICA. Benefits of ICA can enhance commercial optical communications systems experiencing crosstalk caused by the use of multiple channels of information.

**Technical Details**

ICA determines an inverse transformation matrix to separate a mixed polarization signal. Because ICA requires two statistically independent polarizations, it avoids the problem associated with CMA of polarization convergence. With statistical independence and a tensor-based algorithm, the inventors have demonstrated polarization demultiplexing using ICA without any extra parameters on an experimental quadrature phase shift (QPSK) system and simulated QPSK and 16-QAM systems.

**Benefits**

- Polarization-division demultiplexing without prior knowledge of modulation format

**Applications**

- Optical communications

**Technology #32124**

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