
Memory Effects in Multimode Fibers

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Abstract

The ideal geometry of a perfect fiber leads to symmetries that can be exploited for imaging. This manifests itself through the existence of memory effects, i.e., operations that have the same effect on the output field whether applied before or after propagation through the fiber (they commute with the propagation operator). Analogously to scattering media, these effects can be harnessed for imaging even without access to the distal facet. However, small distortions and imperfections of the fiber tend to destroy these effects. Moreover, the fiber geometry admits an obvious transformation that yields a memory effect: rotation. Yet this transformation lacks radial information, limiting its utility for imaging. We present a new framework for generating and exploiting random memory-effect operators that harness the orbital angular momentum of the fiber modes for image reconstruction.

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