Equalization of Modal Dispersion in Multimode Fiber Using Spatial Light Modulators

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Intersymbol interference (ISI) due to modal dispersion is the dominant limitation to the bit rate-distance product in multimode fiber-optic communication systems. If the light launched into the fiber excites only the desired principal modes, modal dispersion can be eliminated. We can achieve this by using spatial light modulators (SLMs) to perform adaptive spatial filtering on the electric fields of the light. In this paper, we develop an optimization framework for setting the SLMs to obtain an upper bound on the achievable performance and develop heuristics that nearly reach this upper bound Using this framework, we show that both a sophisticated semidefinite programming-based algorithm and a simple adaptive algorithm achieve performance close to the upper bound. Performance and system complexity tradeoff curves are constructed, showing that a 20 x 20 array of SLM pixels with binary phase control performs within 15% of more complex implementations. Finally, we extend the framework and present preliminary results showing the promise of further increases in the capabilities of multimode fiber by using the fiber as a multiple-input multiple-output (MIMO) transmission medium.