

Seminar

Quantitative Analysis on SDM Potentialities

Space-Division Multiplexing (SDM) is an optical system architecture which exploits the spatial domain through fiber structures like multi-mode fibers (MMFs) and multicore fibers (MCFs). SDM is said to be able to overcome the predicted capacity crunch of the current optical networks [1], which are based on single mode fibers (SMFs) and multiplexing in time, wavelength, polarization and phase.

However, would not it be enough to just deploy larger fiber bundles?

The student task is to understand and re-elaborate in a quantitative (not just qualitative!) way:

1- the reasons of the predicted capacity crunch, referencing, see [1] (and, optionally, [2, 3]).

2- the generic SDM architecture (see, e.g., [1, 4, 5]) and in which sense SDM is expected to be superior to the fiber bundle solution, if in terms of higher capacity, or higher bit-per-area, or lower cost-per-bit, or in which other metric. See [1, 4, 6].

Furthermore, the student should choose at least one application domain (intra data-center network, metro/regional network, long-haul communications) and present a comparison in terms of performance, cost and space occupation between a traditional SMF approach, a light-SDM approach based on fiber bundles, and a future SDM architecture based on MMFs/MCFs (or other exotic fiber structures).

REFERENCES:

[1]: Peter J. Winzer and David T. Neilson. “From Scaling Disparities to Integrated Parallelism: A Decathlon for a Decade”. In: *Journal of Lightwave Technology* 35.5 (2017), pp. 1099–1115.

[2]: A.D. Ellis et al. “Communication networks beyond the capacity crunch”. In: *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 374 (Mar. 2016), p. 20150191.

[3]: Helio Waldman. “The Impending Optical Network Capacity Crunch”. In: *2018 SBFoton International Optics and Photonics Conference (SBFoton IOPC)*. 2018, pp. 1–4.

[4]: George M. Saridis et al. “Survey and Evaluation of Space Division Multiplexing: From Technologies to Optical Networks”. In: *IEEE Communications Surveys Tutorials* 17.4 (2015), pp. 2136–2156.

[5]: Benjamin J. Puttnam, Georg Rademacher, and Ruben S. Luís. “Space-division multiplexing for optical fiber communications”. In: *Optica* 8.9 (Sept. 2021), pp. 1186–1203.

[6]: Werner Klaus et al. “Advanced space division multiplexing technologies for optical networks [Invited]”. In: *Journal of Optical Communications and Networking* 9.4 (2017), pp. C1–C11.

Prerequisites

Basic knowledge of an optical communication system.

Advisors

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