Performance Limitations due to Inter-Core Crosstalk in Coherent Detection Multicore Fiber Based Transmission Systems

Background and challenges

• Multicore fiber (MCF) has been proposed as transmission media for future optical fiber communication systems with coherent detection due to the possibility of space-division multiplexing.
• The inter-core crosstalk (ICXT) is an important performance limitation in weakly-coupled MCFs.
• Rigorous ICXT statistical description is required to derive accurate analytical expressions for the performance metrics for such systems.

In this work:

• Analytical expressions for the coherently detected ICXT variance and for the MCF performance metrics (Bit error rate (BER), optical signal-to-noise ratio (OSNR) penalty) is derived.
• Numerical simulation is used to validate the analytical work.

Description and main innovation

Achievements

• Analytical expressions for the coherently detected ICXT variance, BER and OSNR penalty have been validated through numerical simulation, that allows to assess rigorously the performance limitations due to the ICXT in coherent-detection MCF systems.
• Work presented in:

\[ X_c \] - ICXT level; \( M_n \) - modulation format order (core n) \( M_m \) - modulation format order (core m)
\[ H^{(c)}_{RRC}(f), c \in \{m, n\} \] - Transfer function of root raised cosine filter; ASE – Amplified spontaneous emission.

Coherently detected ICXT variance as a function of modulation format order, time misalignment and skew.