Chair of Communications Engineering
TUM Department of Electrical and Computer Engineering
Technical University of Munich

Master's Thesis

Achievable rate of Wiener and Markov phase noise channels

The Nonlinear Schrödinger Equation (NLSE) describess propagation in optical channels. Its nonlinearity can be modeled as Gaussian phase noise with memory [1, 2]. A popular simplification of this model is the Wiener phase noise model, which has been used to compute capacity lower bounds [3]. However, the Wiener phase noise model is statistically inaccurate in the sense that it tends to a uniform distribution instead of a Gaussian one. We have recently proposed a Markov-Gaussian phase noise model that is statistically closer to the NLSE.

The goal of this thesis is to explore capacity bounds on the Wiener and Markov phase noise models and compare them.

[1] A. Mecozzi and R. Essiambre, "Nonlinear Shannon Limit in Pseudolinear Coherent Systems," in Journal of Lightwave Technology, vol. 30, no. 12, pp. 2011-2024, June15, 2012, doi: 10.1109/JLT.2012.2190582.

[2] Ronen Dar, Meir Feder, Antonio Mecozzi, and Mark Shtaif, "Properties of nonlinear noise in long, dispersion-uncompensated fiber links," Opt. Express **21**, 25685-25699 (2013)

[3] M. Secondini, E. Agrell, E. Forestieri and D. Marsella, "Fiber Nonlinearity Mitigation in WDM Systems: Strategies and Achievable Rates," 2017 European Conference on Optical Communication (ECOC), Gothenburg, 2017, pp. 1-3, doi: 10.1109/ECOC.2017.8346177.

[4] F. J. García-Gómez and G. Kramer, "Mismatched Models to Lower Bound the Capacity of Optical Fiber Channels," in Journal of Lightwave Technology, vol. 38, no. 24, pp. 6779-6787, 15 Dec.15, 2020, doi: 10.1109/JLT.2020.3021277.

Prerequisites

Information Theory

Advisors

Francisco Javier Garcia Gomez