Associative Professorship of Line Transmission Technology
TUM Department of Electrical and Computer Engineering
Technical University of Munich

Seminar

Computing Discrete Eigenvalues by Contour Integrals in the Nonlinear Fourier Domain

In an attempt to improve achievable rates for optical communication systems in the high input power regime, modulation via the nonlinear Fourier transform (NFT) has attracted some attention in recent years. Many NFT algorithms however still exhibit high computational complexity that has to be addressed. One very recent approach focuses on the computation of the discrete eigenvalues of a received pulses nonlinear Fourier spectrum by using the well-known Delves-Lyness zero-search algorithm [1-2].

The students task would be to first get a basic grasp of the NFT by having a look at [3] and an overview on existing methods from [4]. Subsequently, by studying references [1-2] (mostly [1]) the student should get a good understanding of the described contour integral method.

At the end of the seminar the student should be able to give a basic introduction into NFT-aided optical communication systems and give an explanation of the method from [1-2] (mostly using [1]), identify benefits and drawbacks compared to other existing methods and also discussing the simulation results for the test cases presented in the paper.

[1] Vasylchenkova, Anastasiia, Prilepsky, Jaroslaw . "Contour integrals for numerical computation of discrete eigenvalues in the Zakharov-Shabat problem"

[2] Delves, L. M., Lyness, J. N. "A numerical method for locating the zeros of an analytic function"

[3] Yousefi, Mansoor I., and Frank R. Kschischang. "Information transmission using the nonlinear Fourier transform, Part I: Mathematical tools."

[4] Yousefi, Mansoor I., and Frank R. Kschischang. "Information transmission using the nonlinear Fourier transform, Part II: Numerical methods."

Prerequisites

Optical Communication Systems, Nonlinear Optics (both are not stricly necessary but highly beneficial for this topic)

Advisors

Benedikt Leible