Two PhD Studentships - Funded by Israeli Science Foundation

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING, FACULTY OF ENGINEERING, BEN GURION UNIVERSITY OF THE NEGEV, BEER-SHEBA, ISRAEL

PROJECT TITLE: INCREASING THE INFORMATIONAL CAPACITY OF OPTICAL NETWORKS BY MEANS OF THE NONLINEAR FOURIER TRANSFORM

Applications are invited **for two three year Ph.D. studentships** at Electrical and Computer Engineering Department of the BGU supervised by Dr Stanislav Derevyanko. The successful applicant will perform theoretical analysis and numerical simulations of the informational capacity limits of the fiber-optical telecommunication systems employing the new modulation format based on the Nonlinear Fourier Transform .

THE POSITIONS ARE AVAILABLE TO START IN OCTOBER 2018/MARCH 2019 (SUBJECT TO NEGOTIATION)

Salary: The successful candidates will be employed on a full-time basis with a competitive salary of 56,000 NIS pa. Eligible candidates can also apply for multiple scholarships available to the postgraduate students at BGU.

BACKGROUND OF THE PROJECT

Optical fiber systems are responsible for the overwhelming majority of the world's information traffic and currently serve as the backbone of global telecommunications networks. One salient feature that sets optical communications apart from satellite and wireless transmission and that makes the technological challenge of fulfilling current optical fiber network requirements particularly formidable is the detrimental impact of fiber nonlinearity on the maximum error-free transmission rate (i.e., channel capacity). Thus, increases in the input power aimed at growing the capacity of the system are accompanied by degradations in overall performance due to nonlinearity induced inter- and intra-channel cross talk. This scenario effectively sets an upper limit on achievable transmission rate in bits per second in single-mode optical fiber systems. Moreover, the current world traffic demand is worryingly close to this limit, which, it has been estimated, we will already reach within the next decade .

There is a clear need for radically different methods for the coding, transmission, and processing of information that take the nonlinear properties of the optical fiber into account. The project seeks to employ the nonlinear Fourier transform (NFT) based on the rigorous mathematical procedure of solving the Nonlinear Schrodinger Equation for the development of new engineering techniques for the coding, modulation, transmission, and processing of information in optical fiber channels. In particular it aims to answer the fundamental question of whether the NFT based transmission is capable of increasing the achievable information transmission rates .

The project therefore is highly *multidisciplinary* and lies in the intersection of *applied mathematics* (soliton theory), *optics* (in particular the nonlinear fiber optics) and *communications* (information theory). The students will work on the theoretical estimates of channel capacity of optical systems based on the NFT scheme, perform numerical simulations of the achievable information rates in such transmission systems and cluster Monte-Carlo simulations of the statistics of the NFT channels.

SPECIFIC SKILLS SOUGHT

We are looking for candidates with exceptional skills in applied mathematics and/or optical communications. Preferred skill requirements include nonlinear physics, knowledge of scientific programming and computing, information theory.   Knowledge of High Performance Computing, physical optics, telecommunications is an asset. Applicants with a Master of Science degree in Electrical Engineering, Applied Mathematics, Physics, or equivalent, are especially encouraged to apply.

ADDITIONAL FORMAL REQUIREMENTS

The successful applicant will be enrolled at [Kreitman School of Advanced Graduate Studies](#) at BGU. Please note that the Kreitman school of Advanced Graduate Studies serves as the administrative framework for graduate and post-graduate students at Ben-Gurion University of the Negev. The candidates therefore must meet the [admission requirements](#) - including English language proficiency. The students will be members of the [Electrical and Computer Engineering Department](#) and adhere to [ECE Ph.D. policies](#).

For all the enquiries about the position, contact Dr. Stanislav Derevyanko: stasd@bgu.ac.il