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Stabilizing Raman crosstalk in massive WDM transmission networks by frequency dependent gain and loss

Avner Peleg
Afeka College of Engineering, Israel

Raman crosstalk is one of the major impairments in massive wavelength-division-multiplexing (WDM) optical fiber communication systems and an obstacle for achieving scalability in WDM fiber optics networks. In this work, we present a theoretical method for mitigation of Raman crosstalk by employing frequency dependent amplification, such that high-frequency communication channels are over-amplified, while low-frequency communication channels are under-amplified compared with mid-frequency channels. Our method is based on showing that the dynamics of optical pulse amplitudes in an N-channel transmission system can be approximately described by a relatively simple predator-prey model for N species. Numerical simulations with the full propagation model, consisting of a system of N coupled nonlinear Schrödinger equations, show stable long-distance propagation of the optical pulses in good agreement with the predictions of the simplified predator-prey model. Moreover, we theoretically demonstrated that transmission stability can be further enhanced in nonlinear waveguide couplers due to efficient mitigation of radiative sideband generation by the frequency dependent linear gain and loss.

Biography

Avner Peleg has received his PhD degree in Physics in 2001 from the Hebrew University of Jerusalem. He was a Post-doctoral Research Associate at Los Alamos National Laboratory and at the University of Arizona. He was an Assistant Professor at the University at Buffalo. He has published more than 30 papers in scientific journals and has been serving as an Editorial Board Member of the Heliyon journal.

avpeleg@gmail.com

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