PAM-4 Data Transmission using Modulation Instability Frequency Combs on a Kerr Microresonator platform

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Optical frequency combs have found their applications in many areas over the past decade. One type of comb generation observed in microresonators which relies on the Kerr effect has been of particular interest in many areas of ultrafast optics due to the advantages of having a broad comb bandwidth and low threshold powers for parametric gain. These Kerr optical frequency combs have been used in a wide variety of applications including spectroscopy, frequency metrology, LIDAR, microwave to optical links and optical communication. In this work, we demonstrate an application of optical communication by creating a communications link consisting of a data transmitter and receiver. The optical carrier signals are generated by pumping a microresonator ring and accessing the Kerr optical frequency comb. The comb states can be classified into the MI comb states and the soliton comb states. The individual wavelengths of the soliton frequency comb are demultiplexed and modulated with a PAM-4 modulation scheme using an electro-optic intensity modulator. We multiplex these different carriers again and send it through optical fiber. At the output we again demultiplex the carriers, receive the transmitted signals and make an estimate of the BER of the received data by considering the eye diagrams of the signals.

The Kerr microresonator used in our experiments has an FSR of 300 GHz and spans a bandwidth of about 35 THz which generates about 120 different optical frequencies. Considering a 40 Gbps PAM-4 data transmission rate (generated by 1Gbps of NRZ signals) on a single channel, it would be possible to transmit over 520 Gbps through this single optical communications link for the 13 channels. Higher transmission rates can be achieved by higher RF modulation data rates or more number of channels (achieved by interleaving two separate combs or reducing FSRs). This large bandwidth combined with the stability of these combs make them an extremely attractive platform for transmission of data at high rates with low BERs.

Biography

Chinmay Shirpurkar has completed his Bachelor of Technology in Electrical Engineering from the Indian Institute of Technology, Gandhinagar and is currently pursuing a PhD. in Optics and Photonics from the College of Optics & Photonics (CREOL) at the University of Central Florida. His research interests include ultrafast photonics, metrology and optical communications.

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