Optical Comb Source and its Application on Wavelength Multicasting

PhD Proposal Seminar by

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Abstract:
Recent bandwidth-demanding applications have brought a need for high capacities in signal transmission and processing. In addition to traditional electrical domain, photonics-assisted or even all-optical approaches greatly benefit the performance of communication networks and signal processing systems in speed, bandwidth, and scalability. Early days, in the emergence of optical fiber communications, the nonlinear phenomenon such as four-wave mixing (FWM) is generally regarded as negative impact on system operation due to the creation of interference crosstalk between adjacent channels. On the other hand, nonlinear optical processes indeed provide opportunities to enable a variety of applications in metrology, spectroscopy, optical communications, and optical signal processing. Here, based on the FWM, we investigate the dual-seed optical comb source (OCS) and its application on wavelength multicasting.

In the OCS architecture, two continuous-wave (CW) laser sources are used as seeds to experience a chirp-compression-mixing process in cascaded stages of highly-nonlinear fiber (HNLF) separated by a single-mode fiber (SMF) which can compress the temporal waveform. In the OCS design, the challenges are mitigation of power saturation caused by the stimulated Brillouin scattering (SBS) and management of dispersion profile of the optical fibers. The SBS effect reduces the power available to induce the parametric processes, and the dispersion management dominates the bandwidth of the generated spectrum. Following, the dual-seed OCS is applied to a wavelength multicasting scheme which can generate numerous replicas of an input data-carrying signal at distinct output wavelengths. In this multicasting architecture, the generated comb lines serve as both degenerate and non-degenerate pump waves to mix with a data signal leading to a generation of multiple multicasting replicas through FWM in either a HNLF or a silicon waveguide.

In this proposal, the first part is focused on the study of dual-seed OCS. Secondly, a wavelength multicasting scheme based on the OCS is investigated. The last part will be designed for a potential project on dual-comb spectroscopy where our OCS can support this application.

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