Canada Research Chair APTEC

Advanced Photonic Technologies for Communications

The program of the Canada Research Chair (Tier 1) for Advanced Photonic Technologies for Communications explores new strategies aimed at increasing the amount of information transmitted over optical fiber links with innovative photonic systems and sub-systems. The research addresses current challenges in optical communication networks such as improving spectral efficiency and flexibility with the goal of increasing user bandwidth.

- Novel optical fibers and sub-systems (amplifiers and lasers)

  We examine the design of new optical fibers for spatial multiplexing, i.e. channel transmission at the same carrier frequency over the fiber orthogonal modes. Our objective is to demonstrate fibers with weak coupling modes therefore eliminating the need to use MIMO signal processing at the receiving end.

  We are also studying novel optical fiber amplifiers to increase capacity and bandwidth by proposing novel erbium-doped fiber designs. We further extend this research to high power fiber lasers in collaboration with an industrial partner.

- Digital and analog communications over optical fiber

  At the moment, this research activity consists in exploring modulation formats, specifically intensity modulation – direct detection (IM-DD), which can increase spectral efficiency in short haul links where the transmitter is either a wideband directly modulated laser or an integrated silicon photonic modulator.

- Optical signal processing

  Photonics allows ultrafast signal processing to perform operations such as optical sampling, pulse shaping or signal switching. We are currently studying frequency conversion of optical signals with advanced modulation formats, i.e. coded in amplitude and phase.

- Integrated photonic circuits for communications

  We design, characterize and demonstrate integrated silicon photonic devices at the system level. The research targets the development of modulators and filters in integrated circuits fabricated using CMOS technology in silicon on isolator. We strive to increase modulator performance (speed, extinction ratio) while decreasing their footprint and energy consumption. As for filters, we are developing solutions for reconfigurable spectral responses that are polarization insensitive in order, for example, to perform channel multiplexing/demultiplexing.

- Integrated photonic for sensing

  We are investigating how to integrate an infrared spectrometer on a silicon chip for monitoring applications in remote environments.