Bachelor / Master Thesis:

Digital Signal Processing in Optical Communication Systems

Karlsruhe Institute of Technology

With high-speed digital-to-analog and analog-to-digital converters, complex digital signal processing (DSP) became feasible for optical transmission systems. Being first an interesting topic for researchers, industry developed tremendous interest in the opportunities opened by DSP such as mitigation of linear impairments throughout the whole system, higher order modulation formats (Figure 1), and most recently pulse shaping (Figure 2(b)). The latter two increase the spectral efficiency (SE), increasing the usable capacity of deployed fibers. Higher order modulation formats dramatically reduce feasible transmission distances, posing a limit to increase the SE in deployed systems. Thus main interest lies on higher count of densely packed wavelength channels, requiring specially tailored spectra, Figure 2

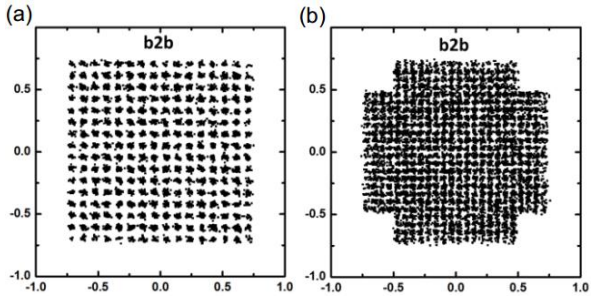

Fig. 1: Quadrature Amplitude Modulation (QAM) with 256 (a) and 512
(b) constellation points, carrying 8 and 9 bits per symbol, respectively.

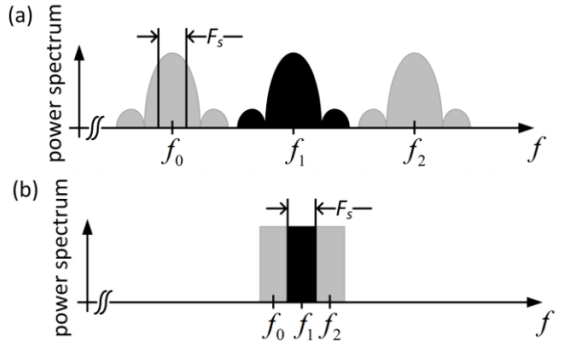

Fig. 2: Three wavelength channels with standard nonreturn-to-zero (a) and Nyquist sinc-pulse shaped signals (b). Pulse shaping allows for virtually zero spacing of wavelength channels, increasing spectral efficiency and thus capacity utilization of the transmission system.

Your tasks:

- Investigation of DSP methods for optical communications.
- Depending on your interest, focus can be set on signaling properties for short or long haul links, programming in Matlab or VHDL.

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