Master Thesis:

Design and implementation of an optic-electronic-optic interferometer with intradyne detection

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Interferometers are a key building block of a wide range of optical systems in optical physics, metrology, and optical communications. Conventional interferometers split and recombine an optical signal after some limited optical processing (Fig. 1(a)). Whereas an optic-electronic-optic (OEO) interferometer first coherently down-converts the optical signal to the electronics domain for processing and then performs subsequent electrical to optical conversion for interference (Fig. 1(b)). Previous studies have identified the OEO interferometer's potential as a reconfigurable add/drop multiplexer for overlapping optical subcarriers [1]. In our earlier work, we conducted proof-of-concept experiments with balanced heterodyne detection, demonstrating add/drop operation for a single-carrier 1GBd QPSK signal [2]. For higher symbol rates and multi-carrier signals, intradyne detection is preferable due to its lower bandwidth requirement compared to heterodyne detection. This master thesis aims to implement intradyne detection and develop necessary DSP algorithms, such as timing recovery and carrier recovery in VHDL, for an OEO interferometer.

Your tasks may include:

- Implement intradyne detection with an integrated coherent receiver.
- Design necessary DSP algorithms in VHDL.
- Experiment to benchmark the performance of add/drop operation.

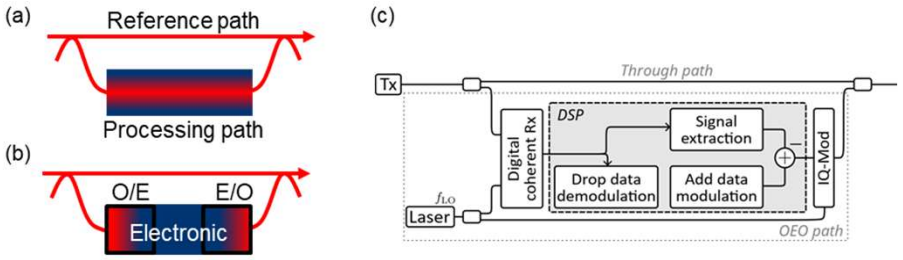

Fig. 1. (a) Conventional interferometer with an optical processing path. (b) OEO interferometer with opto-electronic and subsequent electro-optic conversion. (c) Basic building blocks of an OEO interferometer.

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References:
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[2] Mahmud, *et. al.,* "Coherent Add/Drop Multiplexing Using an Optic-Electronic-Optic …, CLEO, 2023