Computational Photonics Group
Department of Electrical and Computer Engineering
Technical University of Munich

Modeling of Fourier Domain Mode Locked (FDML) Lasers

Master's thesis, Bachelor's thesis
starting immediately

Motivation

Fourier domain mode locking (FDML) is a new stationary laser operating regime besides continuous wave (cw) and conventional mode locked operation. Typical FDML lasers (see Fig. 1) feature a fiber ring resonator, combined with a semiconductor-based optical amplifier (SOA). In FDML operation, a narrowband optical bandpass filter is tuned periodically with a sweep repetition rate that is synchronous to the optical roundtrip time of the circulating light field in the laser, resulting in one or several narrowband frequency sweeps per roundtrip over a wide spectral range (see Fig. 2). FDML lasers can provide superior performance in applications where high speed, narrowband frequency-swept sources are desired, such as optical coherence tomography (OCT) in biomedical imaging.

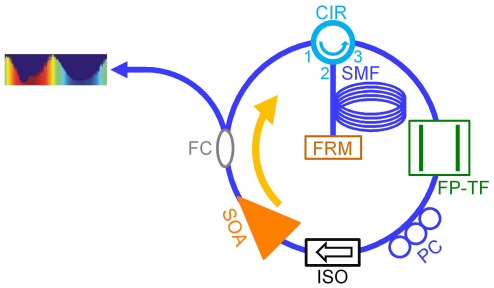

Figure 1 Schematic view of a typical FDML setup.

Objectives

In our research group, we focus on the simulation of the physical properties of FDML lasers in close collaboration with Prof. Robert Huber (Universität zu Lübeck), whose group provides the experimental feedback for the simulations. The goal is the further optimization of the laser and a deeper understanding of the underlying theoretical framework. The student will carry out simulations, and use analytical methods in order to describe the laser dynamics. The tools for our simulations are C++ and MATLAB. This thesis will give the student hands-on experience in laser physics, programming and numerical methods. The emphasis can be put on theory, programming or design and optimization.

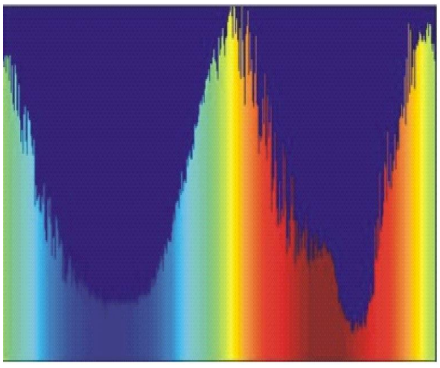

Figure 2 Time dependent power output of an FDML laser.

Requirements

- Interest in device simulation and theoretical work.
- Knowledge of MATLAB and the C++ programming language

Duration

The research scope can be adapted to a Master's thesis (6 months) or Bachelor's thesis (9 weeks).

Contact

Prof. Dr.-Ing. Christian Jirauschek
jirauschek@tum.de
Computational Photonics Group
www.cph.ei.tum.de