AUFGABE DER MASTERARBEIT

im Studiengang „Elektrotechnik und Informationstechnik"

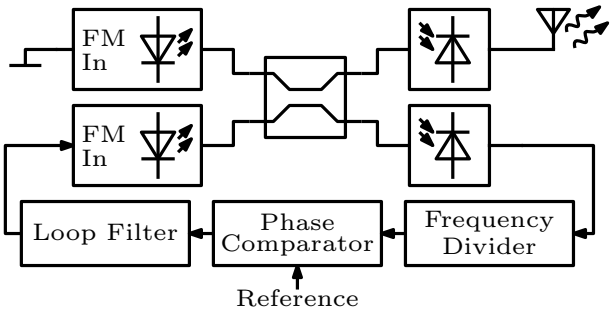
für: Hao ZHUANG

gestellt von: **Prof. Dr.-Ing. Andreas Czylwik**

Thema: Design of a Phase-Locked Loop for Frequency and Phase Stabilization of a Photomixing-Based Microwave Source

One method of generating RF signals is photomixing, i.e. "beating" two infrared laser signals with different frequencies in a high-speed photodiode. The outputs of two fiber-coupled single-mode lasers with wavelengths in the 1550 nm range are superimposed using a fused-fiber coupler and the resulting sum signal is fed into a photodiode. The optical intensity incident on the photodiode and thus the generated photocurrent oscillate at the difference frequency of the two lasers. By tuning the lasers, the frequency of the alternating current can be tuned across a range that is only limited by the tuning range of the lasers and the lowpass behavior of the photodiode.

The inherent disadvantage of this approach is the poor frequency stability of the generated RF signals. The external cavity tunable laser diodes employed in our lab show frequency fluctuations of several tens of MHz. However, they have frequency modulation inputs that allows the laser frequencies to be modulated by up to 100 MHz. As depicted in the figure to the right, this can be taken advantage of by constructing a phase-locked loop (PLL) circuit that locks the phase of the generated RF signal to a highly stable reference. Comparing this to a conventional PLL-based synthesizer, the lasers serve as the voltage controlled oscillator.



The task of this master thesis is the design, implementation, and test of such a PLL circuit for a suitable frequency range between 0.1 and 7 GHz.

The task entails the following steps:

- creating a time and work plan,
- getting familiar with RF generation by photomixing and the theory of PLLs,
- determining suitable specifications for the photomixing source,
- designing a PLL circuit using commercially available integrated circuits,
- designing a PCB layout in EAGLE and assembling the circuits after production,
- measuring the circuit and evaluating the performance of the photomixing source,
- documentation of the work,
- final presentation of the work, and
- submitting a digital copy of documentation and presentation in PDF format.

Zweitgutachter: Prof. Dr.-Ing. J. C. Balzer

Duisburg, _____ Betreuer: _____

Prof. Dr.-Ing. A. Czylwik