

# Diplomarbeit/ Studienarbeit

## Characterization of Frequency Estimators for Radio over Fiber Systems

### Overview

The numerous demand for higher data rates mobile systems increases in a significant manner due to multimedia applications in the current and next era. These potential requirements leads to investigate unused areas in the spectrum, especially around 60 GHz. Optical fiber communication stands up with its huge bandwidth as a prominent media for transportation of data traffic. Therefore, combining the two different domains (E&O) in one system called Radio over Fiber (RoF) can be considered the most suitable and cost-effective solution providing the two promised goals, the mobility and the superabundant bandwidth with a high performance. Moreover, using an advanced modulation formats for instances, multi-phase shift keying (mPSK) to increase the spectral efficiency is preferred, but, for using such as kind of modulations, a heterodyne receiver is required. Therefore, one of the most challenging issues in the up/down conversion is the carrier recovery. Synchronization in terms of timing, frequency, and phase between the local oscillator and the mixing signal has to be established. Feedforward frequency estimators are the suitable solution for the frequency offset estimation and correction. In order to characterize such estimators, several points starting by the accuracy of the estimators, range of estimation, threshold and the readiness for RoF system should be investigated.

### Task Description

1. Understanding the General concepts of the Radio-over-Fiber systems. (System structure, classifications, techniques, etc...)
2. Review of the estimation theory.
3. Review of the frequency estimation principles .
4. Build up the frequency estimators models.
5. Characterize each estimators in terms of estimator bias, estimator variance, observation length .
6. Perform a comparison among the simulated estimators

The researcher after completing this work , will gain experience with RF communications systems, optical fiber systems, and signal processing from different directions like study, analysis, design and setup.

