Faculty of Electrical Engineering & Computer Science
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Measurement Methods on Polarization Mode Dispersion in Fiber Optic Communication Systems.

ABSTRACT - Masterthesis

Polarization Mode Dispersion (PMD) can be a serious limitation on fiber links operating at 10 Gbit/s and above. As network data rates continue to rise, it is becoming increasingly important to understand PMD and its potential impact in transmission system networks. The subject of PMD presents many challenges, including understanding the terminology and the statistical nature of PMD and also comprehending the background to the advanced measurement techniques to evaluate PMD. In this thesis work PMD definition, causes of PMD like birefringence and mode of coupling are described in detail. The impacts of PMD on fiber optic communication systems as well as PMD standards for single mode fiber recommended by ITU (International Telecommunication Union) are also specified.

The research work mainly focuses on the three measurement techniques for PMD. The measurement techniques are Jones Matrix Eigenanalysis, Circular Arc method and Wavelength Scanning method with Three Stokes Parameters. These measurement techniques are described theoretically and compared with help of practical measurements which were performed in the ELOP lab at Hochschule Bremen, University of Applied Sciences. The experimental setup consists of PAT 9000, Tunable Laser Source, Polarization Controller and a single mode optical fiber which has a length of 34.1884 km. PAT 9000 is a universal modular measurement system for polarization analysis as well as characterization of optical signals and components with respect to polarization mode dispersion (PMD). The PMD measurement values obtained from PAT 9000 were plotted with the help of Matlab software tool. The PMD measurement values obtained from these three measurement techniques are analysed and described in detail. The relation between wavelength step size and the PMD of the optical device under test is also explained by conducting these PMD measurement techniques at three different step sizes of 1 nm, 2nm and 3nm.