

Abstract

The aim of this dissertation is the development of optical fiber sensors in the Nano Photonics Research Laboratory of CUT for the measurement of vibrations. Firstly, an extensive literature search was conducted, on the use of fiber optic sensors in vibrations, as well as in other areas, in an effort to identify fields where the use of conventional sensors is not possible. Based on the literature search an analytical presentation was made on the basic fiber optic sensors, the way they are used in industry today, the way they operate, how they are manufactured and their many structures. A great emphasis was given to the description of Fiber Bragg Gratings, especially the way are inserted in the optical fiber but also for their big advantage that all the measurement outputs are encoded in the form of a wavelength, which cannot be corrupted easily. Using the Nanophotonics Research Laboratory of CUT the FBG were created and through the execution of experiments the main advantages and disadvantages of the fiber optic sensors were identified, as well as their comparison with conventional ways of measuring vibrations like accelerometers. The method of experimental modal analysis was used to determine the dynamic characteristics of a metal bar ie its natural frequencies and mode shapes, using the fiber optic sensors. Afterwards with the use of 3D CAD design software the 3D model of the bar has been designed and inserted in the Abaqus Finite Element Software for further analysis and comparison of the results. Finally, there was an attempt to create multiple sensors in one fiber and the ability to take measurements with the same procedures giving the initiation for further research in this field.