Optoelectronic Transducer with an Optical Fiber Transmission Used for Current Measurement

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Abstract

There is a need of current measurement in power lines. A transducer's construction used for current measurement in medium voltage power lines for current values from 100 A to 700 A is shown (Figure 1). The transducer involves magnetic circuit with a gap in which a MEMS structure with a movable beam is placed. The beam is made of silicon with a 50%Ni50%Fe layer deposited by magnetron sputtering (Figure 2). A distribution of magnetic field in the air-gap depends on current supplying a power line (Figure 3). The beam with the ferromagnetic layer is deflected due to effecting magnetic field. The deflection of the beam is measured by a diffuse fiber sensor. Advantages of this type of the sensor are its simple design, high precision of processing, non-electric transmission, low costs and ability of a non-contact measurement. An influence of the transducer's construction parameters on output characteristics and precision of the measurement were analyzed in the study. The Magnetic Fields interface from the AC/DC Module of the COMSOL Multiphysics® software was used during the study.

Reference

[1] A. Suhadolnik et al., Optical fiber reflection refractometer, Sensors and Actuators, Vol B 29, pp. 425-432 (1995)
[2] J. Golebiowski, Microelectromechanical transducer with optical readout for magnetic flux density measurements, Electrical Review, No. 5, pp. 22-26 (2012)
[3] J. W. Judy and R. S. Muller, Magnetically actuated addressable microstructures, Journal of Microelectromechanical Systems, Vol. 6, pp. 249-256 (1997)
[4] S. Binu et al., Fibre optic target reflectivity sensor, Opt Quant Electron, Vol. 39, pp. 747-752 (2007)

Figures used in the abstract

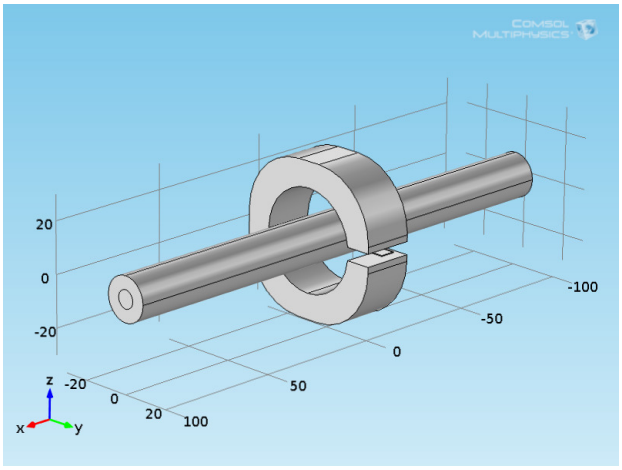

Figure 1: View of the transducer with a ferromagnetic core and the MEMS structure in a gap.

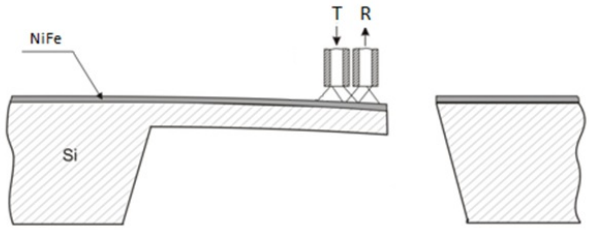

Figure 2: The construction of the MOEMS sensor (movable beam, transmitting [T] – receiving [R] fiber system).

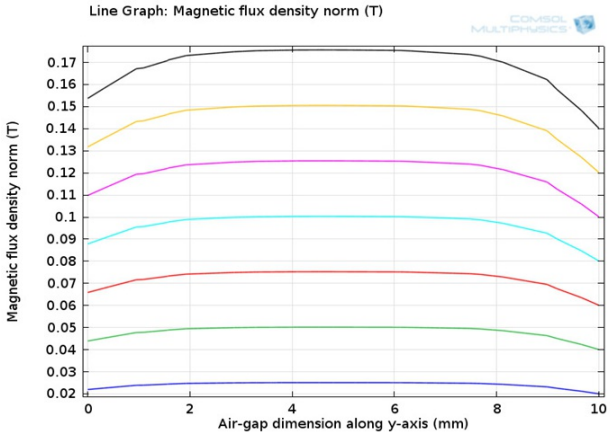

Figure 3: The distribution of magnetic field along the air-gap for different values of supplying current (from 100 A to 700 A).

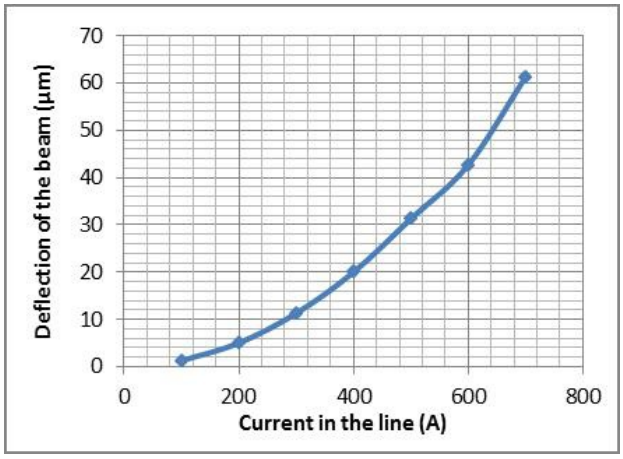

Figure 4: The beam's deflection in function of current in the power line.