Abstract of the PhD thesis by M.Sc. Karol Kuczyński under the title:

"Assessment of the Operating Parameters of the Magnetoelectric Sensor Using Artificial Intelligence Methods"

The essence of the doctoral thesis is research the operating parameters of a magnetoelectric magnetic field sensor built of a PZT (Lead / Plumbum Zirconate Titanate) piezoelectric ring-shaped and the ring-shaped of amorphous metal ribbon. The problem also included understanding the magnetostrictive properties of amorphous alloys. This made it possible to indicate the functional parameters of the sensor under development, influencing its sensitivity. Amorphous metal ribbon are the latest class of soft magnetic materials. Due to the development of new magnetic and piezoelectric materials, it is possible to build sensors for measuring permanent magnetic fields with values up to several hundred A/m. The novelty of the developed sensor is the use of a magnetic element with a closed magnetic circuit. This construction helps to reduce the influence of noise on the useful signal. Thanks to this concept, it is possible to obtain greater sensitivity of this type of sensors than in the case of sensors with open magnetic circuit. The subject of the research were ring cores made of strips made of selected amorphous iron-based ribbons. The alloys selected for research are materials widely used in industrial energy devices and electronic equipment. Based on the research results obtained, a prototype of a ring-shaped magnetoelectric magnetic field sensor was developed and selected tests of its functional properties were carried out. On their basis, using machine learning as a tool, selected operating parameters were modeled. The sensor output signal was regressed with the use of: Multilayer Perceptron MLP, Support Vector Machine regression, regression trees and Gaussian Processes regression. The purpose of their application was to show that with the selected regression methods it is possible to simulate each characteristic of the analyzed sensor. The prototype developed in the work can be used in the construction of energy harvesting systems as well as powering security devices and data transmission. In the future, the use of an intelligent sensor in non-destructive testing is also expected.

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