

## The MHz Frequency Range EM Induction Device Development and Experimental Study for Low Conductive Objects Detection

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**Abstract :** The results of the study are related to the direction of plastic mine detection research using electromagnetic induction, the development of appropriate equipment, and the evaluation of expected results. Electromagnetic induction sensing is effectively used in the detection of metal objects in the soil and in the discrimination of unexploded ordnances. Metal objects interact well with a low-frequency alternating magnetic field. Their electromagnetic response can be detected at the low-frequency range even when they are placed in the ground. Detection of plastic things such as plastic mines by electromagnetic induction is associated with difficulties. The interaction of non-conducting bodies or low-conductive objects with a low-frequency alternating magnetic field is very weak. At the high-frequency range where already wave processes take place, the interaction increases. Interactions with other distant objects also increase. A complex interference picture is formed, and extraction of useful information also meets difficulties. Sensing by electromagnetic induction at the intermediate MHz frequency range is the subject of research. The concept of detecting plastic mines in this range can be based on the study of the electromagnetic response of non-conductive cavity in a low-conductivity environment or the detection of small metal components in plastic mines, taking into account constructive features. The detector node based on the amplitude and phase detector 'Analog Devices ad8302' has been developed for experimental studies. The node has two inputs. At one of the inputs, the node receives a sinusoidal signal from the generator, to which a transmitting coil is also connected. The receiver coil is attached to the second input of the node. The additional circuit provides an option to amplify the signal output from the receiver coil by 20 dB. The node has two outputs. The voltages obtained at the output reflect the ratio of the amplitudes and the phase difference of the input harmonic signals. Experimental measurements were performed in different positions of the transmitter and receiver coils at the frequency range 1-20 MHz. Arbitrary/Function Generator Tektronix AFG3052C and the eight-channel high-resolution oscilloscope PICOSCOPE 4824 were used in the experiments. Experimental measurements were also performed with a low-conductive test object. The results of the measurements and comparative analysis show the capabilities of the simple detector node and the prospects for its further development in this direction. The results of the experimental measurements are compared and analyzed with the results of appropriate computer modeling based on the method of auxiliary sources (MAS). The experimental measurements are driven using the MATLAB environment. Acknowledgment -This work was supported by Shota Rustaveli National Science Foundation (SRNSF) (Grant number: NFR 17\_523).

**Keywords :** EM induction sensing, detector, plastic mines, remote sensing

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