Abstract

The design of modern electronic devices is becoming increasingly complex, which involves the integration of various types of materials, including ferromagnetic materials and permanent magnets. The static and quasi-static magnetic fields generated by these materials have a significant impact on individual components of the system, which makes accurate modeling of permanent magnets and ferromagnetic materials crucial in electromagnetic compatibility (EMC) problems.

This work focuses on the efficient numerical modeling of the interaction of ferromagnetic materials and permanent magnets. The method of moments (MoM), which is based on surface integral equations (SIE), is used for modeling. To solve the system of linear equations obtained through MoM, fast iterative methods (FIS), in particular the adaptive cross approximation (ACA) algorithm, are used to achieve high computational efficiency. The obtained results were validated both by comparison with analytical calculations and through experimental measurements, which confirmed the accuracy and reliability of the model.

The application task is the detection of breaks in the rods constituting a steel rope through a change in the magnetic field, which is a practical application of magnetic defectoscopy.