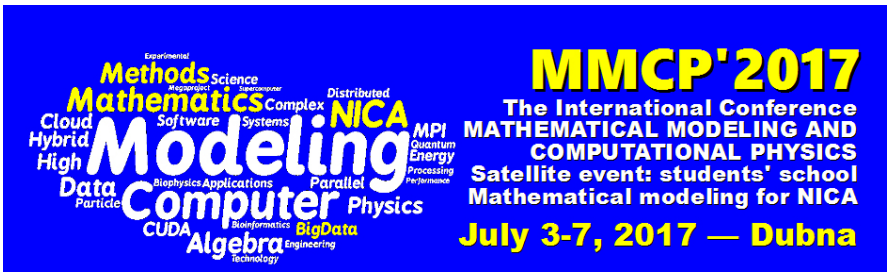

Contribution ID: **44** Type: **not specified**

The Boundary Value Problem for Elliptic Equation in the Corner Domain in the Numerical Simulation of Magnetic Systems

Monday, July 3, 2017 1:45 PM (15 minutes)

The formula¬tion of the boundary value problem arises in magnitostatics when finding the mag¬netic field distribution by the method of two scalar potentials in the domain com¬prising ferromagnetic and vacuum. The problem nonlinearity is stipulated by the dependence of the medium properties (magnetic permeability) on the solution to be found. In connection with that the solution of such a problem has to be found by numerical methods, a question arises about the behavior of the boundary value problem solution around the angular point (the intersection of two environments-vacuum/iron) of the ferromagnetic. The upper estimate for the acceptable growth of the magnetic field in the vacuum region near the corner point of the ferromagnet has been obtained. It is shown that under certain conditions imposed on the magnetic permeability, the magnetic field within the vacuum region in the vicinity of the corner points is limited. An algorithm of thickening differential grid near the corner point has been developed. It allows one to significantly reduce the computation time and simultaneously to increase the accuracy of the solution of the boundary value problem. The results of modeling the magnetic system containing corner points are presented. The problems of creating a homogeneous map of the field of possible solenoid-type magnetic systems of the NICA installation are analyzed. The computations were performed with the help of two software products, i.e. TOSCA and MFC (Magnetic Field Calculation) developed by the authors.

Key words and phrases: magnet systems, mathematical modeling, boundary value problem, elliptic equations, the behavior of solutions in the corner domain.

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Session Classification: Physical processes modeling and related computational methods (I)