PECULIAR FEATURES OF MATHEMATICAL MODELING OF MAGNETIC SYSTEMS IN THE CORNER DOMAIN

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This work is devoted to the studies of the solution behavior of the boundary value problem for a nonlinear elliptic equation in the corner domain. The formulation of the boundary value problem arises in magnitostatics when finding the magnetic field distribution by the method of two scalar potentials in the domain comprising 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 of the ferromagnetic. This work shows that if the magnetic permeability function meets certain requirments, the corresponding solution of the boundary value problem will have a limited gradient. Near the corner point an essential growth of the module of the magnetic field can take place, which leads to the necessity of constructing special numerical algorithms when solving the boundary-value problem. In this paper an upper estimate is given of maximum possible growth of the magnetic field in the corner domain. In terms of this estimate a method is proposed of condensing the differential grid near the corner domain. This work represents an algorithm of constructing an adaptive mesh in the domain with a boundary corner point of ferromagnetic taking into account the character of behaviour of the solution of the boundary-value problem. An example of calculating a model problem in the domain containing a corner point is given. In the present work, we consider the problem of creation of homogeneous map of magnetic system of solenoidal type (see Fig.1, 2). As a result of optimization, the geometric parameters of magnetic system were chosen in such a way so as to get maxmal size of the domain of homogeneity of the magnetic field.

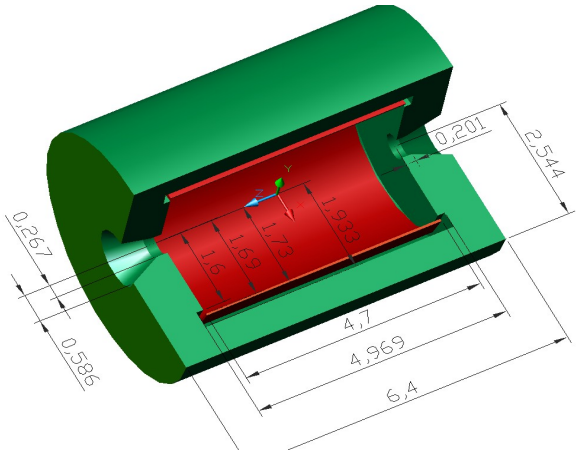

Fig.1 Magnet geometry

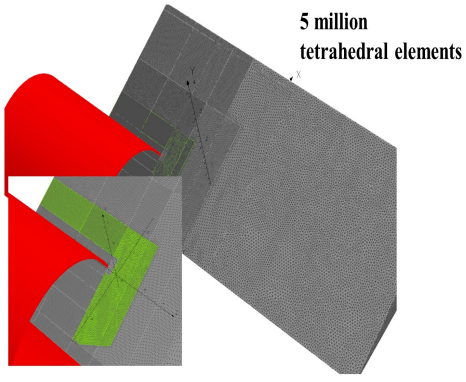

Fig.2

Mesh