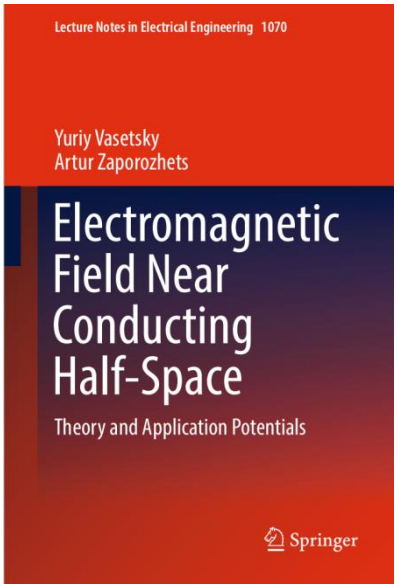

International scientific publisher "Springer" published the monograph "Electromagnetic Field Near Conducting Half-Space. Theory and Application Potentials".

Details about the book can be found at the link
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The authors of the work are the chief researcher of the Institute of Electrodynamics of the National Academy of Sciences of Ukraine, Doctor of Technical Sciences, Professor Yuriy Vasetsky and the Deputy Director for Scientific and Organizational Work of the Institute of General Energy of the National Academy of Sciences of Ukraine, Doctor of Technical Sciences Artur Zaporozhets.

The book is devoted to the solution of one general problem of the theory of a three-dimensional quasi-stationary electromagnetic field. The studies, unlike many well-known works, are based on obtained exact analytical solution of the problem for the field, generated by external current sources near the conducting body with plane surface. The solution for the vector and scalar potentials, electric and magnetic intensities in the dielectric and conducting media is found without restrictions on the configuration of current sources, properties of the media and field frequency.

The presence of exact solution, in addition to the advantage associated with the validity of the results, allows to obtain a number of consequences that are true for an arbitrary field in the system under consideration. These include, in particular, the conclusion that the field of the electric charge distributed on the interface is completely compensates for the normal component of the induced external electric field. As a result, the eddy current flow lines in conductive medium lie in planes parallel to the boundary surface, i.e., the components of the density current and electric field intensity perpendicular to the surface have zero value in the entire half-space. The surface charge density and the vertical component of electric intensity on the interface of media are determined in dielectric medium only by the normal component of induced electric intensity created initial current system. Another consequence of the exact solution is the conclusion that in conductive medium the rate of the inhomogeneous field reduction with depth is always more than the reduction rate of the uniform one.

An integral part of the theoretical study in the book is the development of the method of expansion in asymptotic series for potentials and vector fields. The expansion in asymptotic series is carried out by a small parameter that proportional to the ratio of the field penetration depth to the distance between the source and observation point. This means that the asymptotic method is valid in the case of a strong skin effect, however, in its extended interpretation. The skin effect is considered to be strong, when the depth of field penetration is small compared to not only the characteristic dimensions of the conducting body, but also with the minimum distance from the field sources to the interface.

In the case of strong skin effect, in contrast to commonly used models, expressions, in addition to the local value of vector fields contain their derivatives with respect to a coordinate perpendicular to the interface, thereby determining the influence of field non-uniformity near the surface. The found analytical expressions for the field intensities in the form of asymptotic series make it possible to generalize the Leontovich's impedance boundary condition to the diffusion of non-uniform field into conducting half-space.

The application of the results is illustrated on the example of problems for the development of devices for the processing of welded joints in a strong pulsed electromagnetic field. The use of the developed methods is also reflected in separate articles, references to which are given in the text. In particular, studies were performed to solve the inverse problems of finding the geometry of electromagnetic systems in the field of induction heating of metal products, which are reduced to parametric optimization problems.

The book is intended for the researchers, postgraduate students and students specialized in theory and calculations of electromagnetic fields.