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SIMPLIFIED MATHEMATICAL MODEL OF THREE-DIMENSIONAL ELECTROMAGNETIC FIELD OF ARBITRARY CURRENT SYSTEM NEAR CONDUCTING BODY

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Abstract

Influence of current contour sections oriented at angle to the interface between media is analyzed on the base of the exact analytical solution for three-dimensional electromagnetic field problem for current flowing near conducting half-space. In the case of plane contours parallel to the boundary surface, the problem is simplified and the electromagnetic field is completely determined by the distribution of the vector potential. It is analyzed the possibility of using approximate mathematical model, in which the component of the electric intensity due to the current flow in the direction perpendicular to the surface is neglected. The error in applying the simplified mathematical model is found depending on the angle of inclination of the contour sections and the parameter that determines the distance from the surface of external sources with respect to the depth of field penetration. References 10, figures 4.

Key words: three-dimensional electromagnetic field, eddy current, analytical exact and approximate calculation methods.

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References

1. Kondratenko I.P., Raschepkin A.P. Induction heating of a moving strip current contours. *Tek hnichna elektrodynamika*
. 1999. No 3. Pp. 3-9. (Rus.)
2. Rudnev V., Loveless D., Cook R., Black M. Handbook of induction heating. London: Taylor & Francis Ltd, 2017. 750 p. DOI: https://doi.org/10.1201/9781315117485
3. Batyigin Yu.V., Golovaschenko S.F., Chaplyigin E.A. Magnetic-Impulse Attraction of Nonmagnetic Metals. *Elektrichestvo*. 2014. No 2. Pp. 40-52. (Rus.)
4. Turenko A.N., Batyigin Yu.V., Gnatov A.V. Pulse magnetic fields for progressive technologies. Vol. 3.: The theory and experiment of an attraction of thin-walled metals by pulse magnetic fields. Kharkov: KhNADU, 2009. 240 p. (Rus.)
5. Stepanov G.V., Babutskiy A.I. Effect of high-density pulsed electric current on strength of metallic materials and stress-strain state of structural components. Kyiv: Naukova dumka, 2010. 276 p. (Rus)
6. Vasetskiy Yu.M. , Kondratenko I.P., Rashchepkin A.P., Mazurenko I.L. Electromagnetic interactions between current contours and conductive medium. Kyiv: Pro Format, 2019. 221 p. (Rus)
7. Polivanov K.M. Theoretical bases of electrical engineers. Vol. 3. The theory of electromagnetic field. Moskva: Energiya, 1969. 352 p. (Rus)
8. Shneerson G.A. Fields and transients in ultra-high current equipment. Moskva: Energoatomizdat, 1992. 416 p. (Rus)
9. Vasetskyi Yu.M., Dziuba K.K. An analytical calculation method of quasi-stationary three-dimensional electromagnetic field created by the arbitrary current contour that located near conducting body. *Tekhnichna Elektrodynamika*. 2017. No 5. Pp. 7-17. (Rus) DOI: https://doi.org/10.15407/techned2017.05.007
10. Vasetsky Yu.M., Dziuba K.K. Three-Dimensional Quasi-Stationary Electromagnetic Field Generated by Arbitrary Current Contour Near Conducting Body. *Tekhnichna Elektrodynamika*. 2018. No 1. Pp. 3-12. DOI: https://doi.org/10.15407/techned2018.01.003

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