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CALCULATION OF PROFILES OF SOLENOIDS FOR GENERATION OF HIGH PULSE MAGNETIC FIELDS WITH GIVEN DISTRIBUTION ON AXIS

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Abstract

Mathematical formulations of magnetic field continuation from axis of symmetry for magnetic flux and scalar magnetic potential are described. Analytical solutions of the problem are obtained by two methods. The first method is based on partial solutions, which depend on parameter continuously, and Fourier's transformations of given magnetic induction distributions on the axis. In the second method Green's function for magnetic flux of annular current in unlimited nonconducting and nonmagnetic space is used. It is proved, that this function is solution of magnetic flux continuation from axis of symmetry under certain condition. The application of coaxial annular currents and Green's function, which contains complete elliptic integrals, for calculation of different pulse magnetic induction distributions on axis of symmetry and corresponding profiles of massive single-turn solenoids is shown. Influence of value and direction, radiuses and location of these currents on magnetic induction distribution is investigated. Integral Fourier's transformations for some function are founded that extend scope for application of the first method problem solution. References 8, figures 4.

Key words: pulse magnetic field, profile of single-turn solenoid, field continuation problem,

Green’s function, Fourier’s integral transformation.

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References

1. Dashuk P.N., Zaients S.L., Komelkov V.S., Kuchinskoi G.S., Nikolaevskaia N.N., Shkuropat P.I., Shneerson G.A. High pulse current and magnetic field technique. Moskva: Atomizdat, 1970. 472 p. (Rus)
2. Shneerson G.A. Fields and transients in the equipment of superpower currents. Moskva: Energoatomizdat, 1992. 416 p. (Rus)
3. Neiman L.R., Demirchian K.S. Theoretical fundamentals of electrical engineering. Vol 2. Leningrad: Energoizdat, 1982. 416 p. (Rus)
4. Lebedev N.N., Skalskaia I.P., Ufliand Ia.S. Compilation of mathematical physics problems. Moskva: GITTL, 1955. 420 p. (Rus)
5. Lavrentev M.M. About certain incorrect problems of mathematical physics. Novosibirsk, 1962. 352 p. (Rus)
6. Mikhailov V.M. Green’s functions of axisymmetric electric and magnetic fields above flat boundary surface. *Tekhnichna elektrodynamika*. 2018. No 4. Pp. 5-9. (Ukr) DOI: https://doi.org/10.15407/techned2018.04.005
7. Smait V. Electrostatics and Electrodynamics. Moskva: Inostrannaia Literatura, 1954. 604 p. (Rus)
8. Bronshtein I.N., Semendiaev K.A. Handbook of mathematics for engineers and students of technical universities. Moskva: Nauka, 1986. 544 p. (Rus)

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