Ceco Dushkin, Masayoshi Nawa, Toma Fujita, Seichiro Nakabayashi. MAGNETIC FIELD- AND FORCE-DISTRIBUTION IN SUPERCONDUCTING MAGNETS

High magnetic field created in the bore of a commercial superconducting magnet is of increasing application in levitation of objects and materials processing. Here we calculate the space distributions of the magnetic field and force assuming single thick solenoid of effective geometry and physical parameters providing the same field as the commercial magnet of unknown or rather complicated construction. The radial dependence is obtained as power series with coefficients the derivatives of the central-field function with respect to the axial coordinate. The proposed theory is verified with experimental data for two superconducting magnets of maximum magnetic fields 10 T and 4 T and bore diameters 15 cm and 40 cm, respectively. The detailed maps of the magnetic field allow predicting the zone for stable levitation of diamagnetic objects. The general validity of the theoretical approach is demonstrated as simple rules for the design of superconducting solenoids with respect to the width and maximum of the field distribution and the force strength.

***Keywords*:** superconducting magnet, solenoid, magnetic field, levitation, magnetic materials

***PACS number*:** 85.25.L, 85.70.R, 07.55.Db, 75.20, 75.50

Received June 2003

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