Analysis of the magnetic field, force, and torque for two-dimensional Halbach cylinders - DTU Orbit (17/12/2018)

Analysis of the magnetic field, force, and torque for two-dimensional Halbach cylinders

The Halbach cylinder is a construction of permanent magnets used in applications such as nuclear magnetic resonance apparatus, accelerator magnets and magnetic cooling devices. In this paper the analytical expression for the magnetic vector potential, magnetic flux density and magnetic field for a two dimensional Halbach cylinder are derived. The remanent flux density of a Halbach magnet is characterized by the integer p. For a number of applications the force and torque between two concentric Halbach cylinders are important. These quantities are calculated and the force is shown to be zero except for the case where p for the inner magnet is one minus p for the outer magnet. Also the force is shown never to be balancing. The torque is shown to be zero unless the inner magnet p is equal to minus the outer magnet p. Thus there can never be a force and a torque in the same system.

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