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Integrated Pole Design of Permanent Magnet Quadrupole

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An integrated pole concept is introduced to design a permanent magnet quadrupole (PMQ) using tuning modules for multiple magnetic field gradients. The four poles of PMQ form an integral whole, which is essential for the high-quality quadrupole magnetic field produced by the permanent magnet quadrupole magnet that exploits symmetry. This paper conducts simulations to examine the effects of four distinct types of pole position coordinate errors on the central magnetic field. By juxtaposing these results with those derived from optimal design scenarios of PMQ, the study underscores the critical role that pole symmetry plays in this context. Two integrated design methodologies were proposed, with one of the designs undergoing processing and coordinate detection. The results indicated that this design, in comparison to conventional errors, was capable of meeting the specified requirements. This design effectively addresses the issue of asymmetrical pole installation, thereby ensuring to a certain extent that well-machined poles can generate a high-quality magnetic field.

Footnotes

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