COMPUTATION OF TRANSFER MAPS FROM SURFACE DATA WITH APPLICATIONS TO LHC QUADRUPOLES AND ILC DAMPING RING WIGGLERS

C.E. Mitchell, UMD, College Park, Maryland

Abstract

Transfer maps for magnetic elements in storage and damping rings can depend sensitively on nonlinear fringe-field and high-order-multipole effects. The inclusion of these effects requires a detailed and realistic model of the interior and fringe magnetic fields, including their high spatial derivatives. A collection of surface fitting methods has been developed for extracting this information accurately from 3-dimensional magnetic field data on a grid, as provided by various 3-dimensional finite element field codes. The virtue of surface methods is that they exactly satisfy the Maxwell equations and are relatively insensitive to numerical noise in the data. These techniques can be used to compute, in Lie-algebraic form, realistic transfer maps for LHC final-focus quadrupoles and for the proposed ILC Damping Ring wigglers. An exactly-soluble but numerically challenging model field is used to provide a rigorous collection of performance benchmarks.

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