

## Field Computation for Accelerator Magnets

Analytical and Numerical Methods for Electromagnetic Design and Optimization

Beschleunigermagneten mathematisch modellieren, optimieren, konstruieren: Dieser von einem Spezialisten am CERN verfasste Band, praxisorientiert und thematisch konzentriert, füllt eine Lücke in der Literatur.

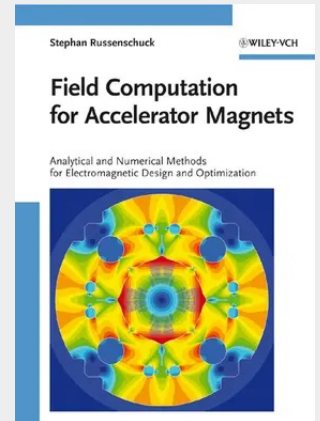
Written by a leading expert on the electromagnetic design and engineering of superconducting accelerator magnets, this book offers the most comprehensive treatment of the subject to date. In concise and easy-to-read style, the author lays out both the mathematical basis for analytical and numerical field computation and their application to magnet design and manufacture. Of special interest is the presentation of a software-based design process that has been applied to the entire production cycle of accelerator magnets from the concept phase to field optimization, production follow-up, and hardware commissioning.

Included topics:

Technological challenges for the Large Hadron Collider at CERN  
Algebraic structures and vector fields  
Classical vector analysis  
Foundations of analytical field computation  
Fields and Potentials of line currents  
Harmonic fields  
The conceptual design of iron- and coil-dominated magnets  
Solenoids  
Complex analysis methods for magnet design  
Elementary beam optics and magnet polarities  
Numerical field calculation using finite- and boundary-elements  
Mesh generation  
Time transient effects in superconducting magnets, including superconductor magnetization and cable eddy-currents  
Quench simulation and magnet protection  
Mathematical optimization techniques using genetic and deterministic algorithms

Practical experience from the electromagnetic design of the LHC magnets illustrates the analytical and numerical concepts, emphasizing the relevance of the presented methods to a great many applications in electrical engineering. The result is an indispensable guide for high-energy physicists, electrical engineers, materials scientists, applied mathematicians, and systems engineers.

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