Service des Accélérateurs, de Cryogénie et de Magnétisme

Vendredi

2

Mars 2007

SEMINAIRE SACM

11 H 00 Oleg Chubar
Synchrotron SOLEIL
Bât.130 Pièce 52

RADIA – a CPU-Efficient 3D Magnetostatics Computer Code

The RADIA 3D magnetostatics computer code was developed at ESRF with the primary goal to facilitate design of insertion devices (undulators and wigglers) for synchrotron radiation sources. As different from the majority of existing magnetostatic codes, which are based on the Finite Element Method (FEM), RADIA uses Finite Volume Integral approach. With this approach, 3D magnetostatics problems are formulated in terms of integral equations with respect to magnetization in mutually interacting volumes. The interacting volumes are subdivided into a number of “elementary” polyhedrons, for which constant (yet varying from one “elementary” polyhedron to another) magnetization vectors are assumed. Magnetic field created by a uniformly-magnetized polyhedron at any point in space can be represented as a product of analytically-calculated 3x3 matrix (which depends on the point coordinates and the polyhedron shape) by magnetization vector. The entire magnetostatics problem can therefore be approximated by a fully-occupied large “interaction matrix” with its components being calculated analytically for a given set of “elementary” polyhedrons, and the corresponding material relations. A typical number of “elementary” polyhedrons required for a given field accuracy level is considerably smaller in this approach compared to that of the FEM, allowing one to obtain a numerical solution faster than with the FEM. The most spectacular performance gain (10 - 30 times less CPU time) takes place for distributed “opened to infinity” geometries, which are typically used for insertion devices. The talk will illustrate RADIA calculations performed for different types of insertion devices and accelerator magnets with permanent-magnet and iron type materials. Recent practical results of shimming SOLEIL undulators based on Genetic Algorithms with “shim signatures” pre-calculated using RADIA code will also be presented.

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NB : La présentation d’une carte d’identité ou d’un passeport est exigée à l’entrée du centre . Tous les auditeurs extérieurs sont priés de prévenir à l’avance de leur visite : Geneviève VERON, Tél. : 01 69 08 69 49 (UE : délai de 24h, hors UE : délai de 4 jours) .