Karlsruher Institut für Technologie
Fakultät für Mathematik
Institut für Angewandte
und Numerische Mathematik

Lecture in summer term 2010:

Numerical methods for Maxwell's equations

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Friday 9:45-11:15, 1C-04, Allianz building (05.20)

The classical theory of electromagnetism is based on a system of coupled partial differential equations derived by James Clerk Maxwell about 150 years ago. These equations describe the interaction between the electric and magnetic fields, the electric and magnetic flux densities, and the electric and magnetic current densities. Solving Maxwell's equations numerically is challenging problem which appears in many different situations such as, e.g., the cellphone radiation interacting with a human head, or the simulation of a photonic crystal waveguide switch.
In this lecture numerical methods for the time-dependent Maxwell equations will be derived and analyzed. The course will mainly focus on the issue of time-integration. Finite-difference time-domain methods such as the famous Yee scheme will be discussed and compared with alternative approaches such as exponential integrators. The lecture will be given in English. It is intended for students in mathematics, physics and other sciences with basics in ordinary and partial differential equations and the corresponding numerical methods. Knowledge about Maxwell's equations is not yet required because a short introduction to these equations will be provided in the first chapter.

References:

- Matthew N. O. Sadiku
  Numerical techniques in electromagnetics.
  2. ed., Boca Raton, Fla. : CRC Press, 2001.
- Allen Taflove and Susan C. Hagness
  Computational electrodynamics: the finite-difference time-domain method.
  3. ed., Boston : Artech House, 2005.
- More references will be given in the lecture.

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