Fraunhofer

IISB

ADVANCED SIMULATION OF LOSSES IN LITZ WIRE SYSTEMS
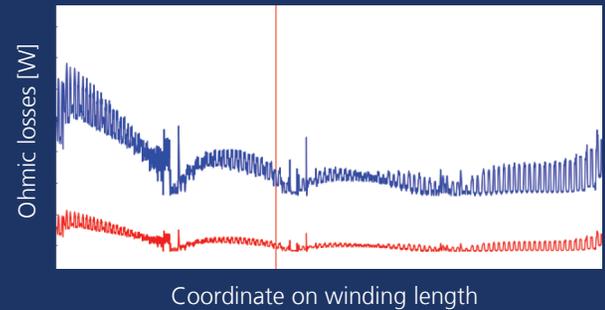
Ohmic losses [W]

Coordinate on winding length
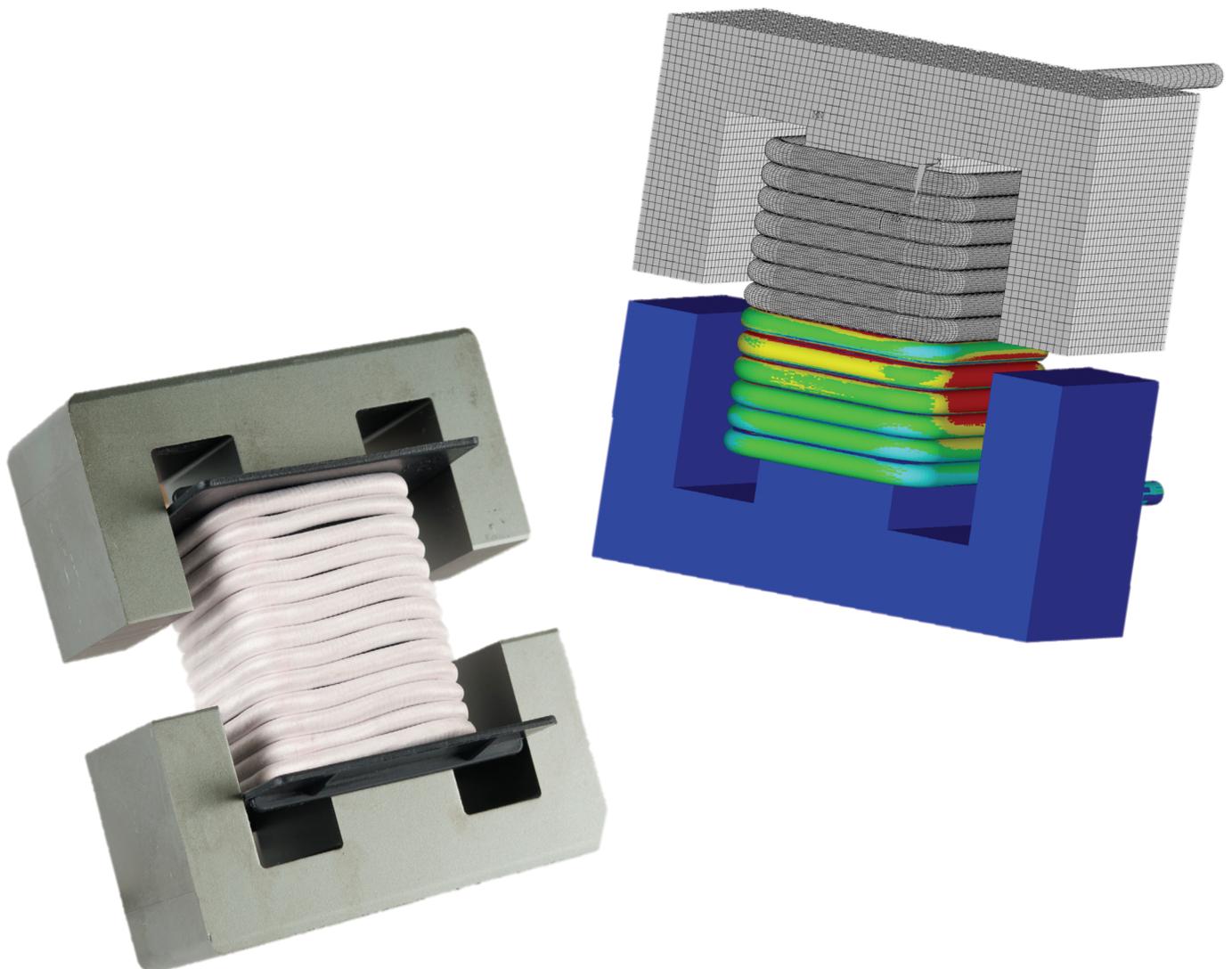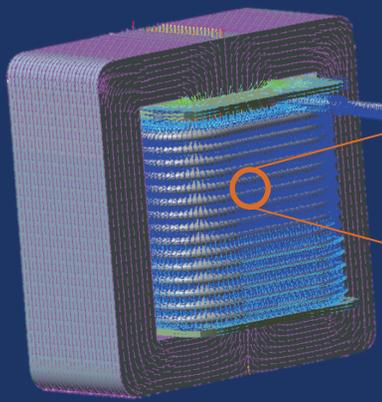
FEM simulation of magnetic field | Current distribution in the strands | Distribution of losses
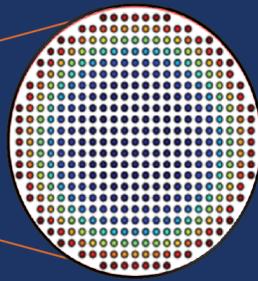
Objectives

The reduction of ohmic losses in inductive components is an important consideration to increase the system efficiency, power density and to decrease the material costs. Therefore, simulation is indispensable as an accompanying development process to reach the ambitious requirements of power electronic systems.

Simulation tool SlicerPro

The analytic tool SlicerPro combines the effectiveness of standard FEM tools (like Ansys15.0) for electromagnetic simulations with highly efficient mathematical algorithms to model the complex behavior of litz wires in electrical systems:

- Spatial resolution of ohmic loss in inductors and electrical systems
- Effects of different litz wires (even hundreds of strands and different contacts) without explicit resolution of the strands in CAD

Fraunhofer Institute for Integrated Systems and Device Technology IISB

Schottkystrasse 10
91058 Erlangen, Germany

Contact

Andreas Rosskopf
Tel.: +49 9131 761-153
andreas.rosskopf@iisb.fraunhofer.de

www.iisb.fraunhofer.de

Software Advantages

- Very accurate loss calculation up to 100kHz
- HF litz wires with several hundreds of strands
- Interface to standard software tools (i.e. via APDL to Ansys15.0)
- Fast and highly efficient through the use of advanced mathematical algorithms
- Implementation in Python with graphical interface and visual output of loss distribution
- Detailed resolution of hotspots in inductors and electrical components
- Generation of output files for import to thermal simulations

Implementation in standard workflow

Initially:
    Electromagnetic simulation in standard FEM tools
Input
- arbitrary CAD file
- **conductor as solid wire**

SlicerPro
Import of magnetic field distribution along the conductor by output files or direct interface (Ansys15.0)
- selection of litz wire and contact type
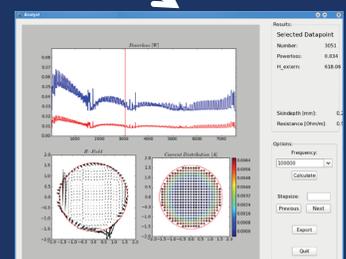- operating frequency
Output:
- current and loss distribution along the conductor
- visualization of hotspots
- export of loss and resistivity data

Export of loss data to standard thermal tools

SlicerPro visualization
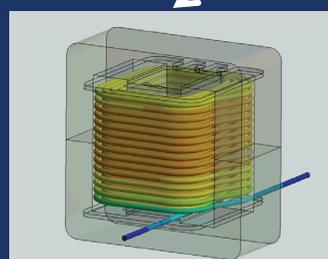
Heat distribution

SlicerPro visualization