# Seminar 24 Monday June 18, 2001

## DESIGN OF MAGNETIC COMPONENTS 9:00am – 6:00pm

**Instructor: Prof. Manfred Albach, University Erlangen, Germany**

### ABOUT THE INSTRUCTOR

Prof. Manfred Albach received his PhD from technical University in Berlin for his investigations on skin effect problems in rectangular wires. In 1983 he started as research engineer with Philips in the field of switch mode power supplies. His main emphasis was on EMC problems and on the various aspects in the design of high frequency operated magnetic components. Prof. Albach holds 20 patents and has published 28 articles.

Since 1999 he has the Chair of Electromagnetic Fields at the University Erlangen. His research activities are mainly focused on the integration of passive L-C-T structures and on the large signal and dynamic behaviour of transformers under high frequency operation.

### CONTENTS

After shortly reviewing the basics this seminar mainly provides the necessary information for optimising the design of magnetic components to be used in switch mode power supplies, lamp ballasts, drives or similar high frequency applications. The course is supported by means of an adequate magnetics design software tool, which is used to visualise the various underlying physical effects generally involved in magnetics. Several designs are analysed on-line, thus leading to a better understanding of the do's and don'ts in the optimization process.

- **The characteristics of the core types**
  the effective core parameters
- **The characteristics of the ferrite grades**
  saturation flux density, initial and amplitude permeability, conductivity
- **Sensitivity analysis of a design**
- **Loss mechanisms in the core**
  the influence of the ferrite grade, the influence of the geometry
  core losses in case of sinusoidal currents, core losses in case of arbitrary current shapes
  influence of premagnetization, influence of subloops
  the principle of the equivalent frequency
- **Design guidelines for the minimisation of core losses**
- **Loss mechanisms in the winding**
  rms losses
  skin losses in round wires, Litz wires, rectangular wires
  proximity losses in round wires, Litz wires, rectangular wires, screens
- **Really two dimensional loss distribution in the winding**
  magnetic field distribution in the winding area
  overcoming Dowells one-dimensional approach
  edge effects
  influence of the air gaps (number, size, position)
  influence of the winding capacitance
  paralleling of wires
- **Design guidelines for the minimisation of winding losses**
  optimisation strategies
- **Thermal modelling**
- **Equivalent circuit modelling**
  winding capacitances and leakage inductances
  how to influence these parameters
- **EMC related problems caused by improper design of chokes and transformers**
  how to improve the performance of filter chokes
  reduction of electric and magnetic fields from converter chokes
  EMC behaviour of different core types
  common mode noise reduction in transformers

### WHO SHOULD ATTEND

Engineers, preferably from R&D, who try to get a better understanding of the physical background involved in the design of high frequency operated magnetic components and all the others, who really need improved designs.