

# Magnetic Design and Application

## Design Services

- Concept development for electromagnetic devices
- Modeling and optimization by FEM analysis, analytical models or individually developed numerical tools developed for specific application fields
- Robust design considering geometrical tolerances and variations of material properties.
- Specification of materials and components based on detailed knowledge of real-life material properties and manufacturing processes

## Application areas

### Electrical machines (motors, generators, actuators)

- Static torque, cogging torque and ripple optimization
- Dynamic behavior, losses, efficiency

### Force and torque

- Holding magnet systems: Electric, permanent or switchable
- Magnetic couplings/clutches

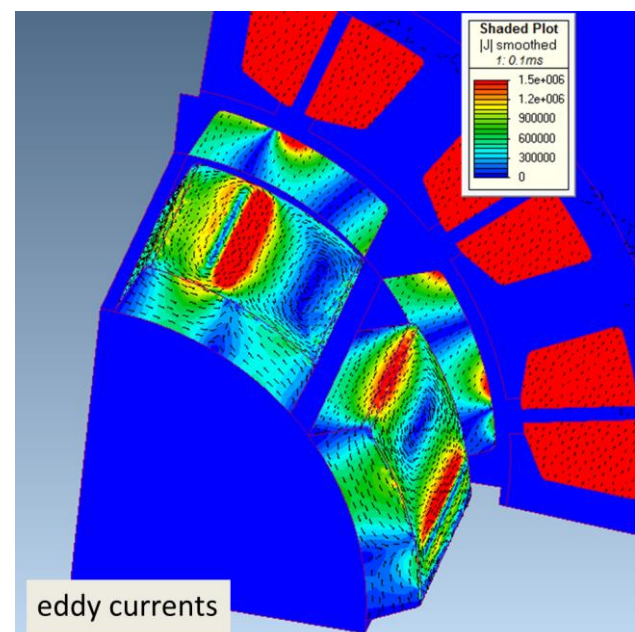
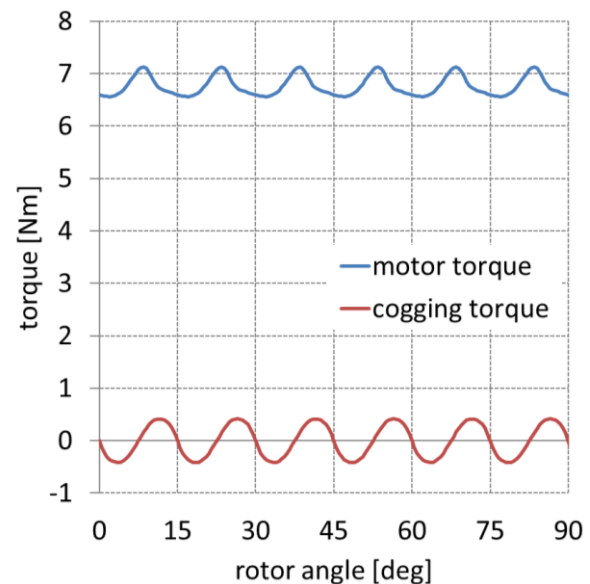
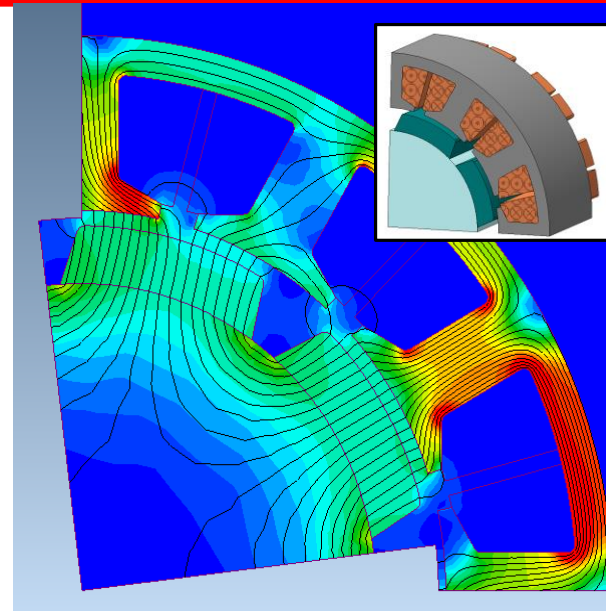
### Contactless position sensing

- Magnetic configurations for linear or rotary position sensors
- Multipole magnetizing of permanent magnets

## Complementary services

### Problem analysis and troubleshooting

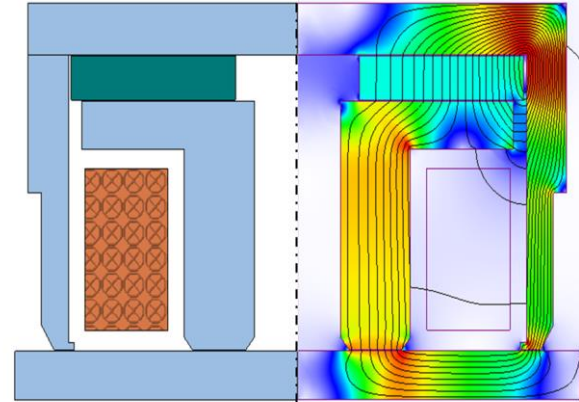
- Root cause investigation of failures by combination of material analysis, magnetic measurements and FEM simulation of failure modes
- Suggestions for design modifications ensuring reliable operation
- Development of adequate specifications for purchasing and inspection of components



# Technical Equipment

## Electromagnetic design

- Proficient use of leading FEM software packages for 2D, 3D and transient/motion modeling
- Proprietary tools based on analytical expressions or basic numerical algorithms for numerous application areas.
- Decades of experience in designing electromagnetic applications
- Cost-effective solutions based on intricate knowledge of production processes.
- Robust designs by awareness of real-life material properties, tolerances and manufacturing routes.



## Physical magnetometry

- BH-curve tracer (Permagraph)
- AC electrical steel testing
- magnetometer with in-situ microscopy unit
- impulse magnetizer
- Helmholtz-coil

## Chemical analysis / corrosion

- atom emission spectroscopy, atom absorption spectroscopy, mass spectrometry with induction-coupled plasma
- carrier gas hot-extraction (CGHE)
- corrosion testing:  
salt spray test (DIN EN ISO 9227),  
HAST (DIN EN 60068-2-66),  
PCT (DIN EN 60749-33)

## Further analytic methods

- processing technology of sintered materials (ceramics, composite materials, sintered magnets)
- battery testing
- X-ray diffractometer for phase analysis, stress measurement and in-situ high temperature measurement
- destructive material testing
- 3D-X-ray-computed tomography with micro- and nano-focus tube

In collaboration with Aalen University, Materials Research Institute

