Tutorial 3:

Sunday May 3, 2009 1:00 PM – 4:00 PM

Magnetic Properties under Real Working Conditions and Modeling of Magnetic Devices

Speaker: Norio Takahashi (Okayama Univ., JAPAN)

Admission Fee: Free

Summary:

It is sometimes pointed out that the results of magnetic field analysis are different from the measured ones. This may be due to the insufficient modeling of magnetic characteristics, by ignoring, for example the effect of stress, iron loss under distorted rotating flux. In this lecture, recent development of modeling of magnetic characteristics including newly measured results is discussed and related topics, such as modeling of divided magnets, newly developed optimal design method, are shown.

Contents:

1. Real working conditions of magnetic material
   (1) Stress (compressive stress, cutting strain, shrink fitting)
   (2) Temperature
   (3) Rotating flux
   (4) DC bias
2. Effect of contact resistance on ac loss of divided Nd-Fe-B sintered magnets
3. Modeling of magnetic devices
   (1) Local heating of reactor
   (2) Iron loss of motor
   (3) Electromagnetic inspection of defect in steel
4. Optimal design of magnetic device using ON/OFF method

Tutorial 4:

Sunday May 3, 2009 1:00 PM – 4:30 PM

Using FEA for Electric Machine Design
Speaker:
Admission Fee: $150.00

Using FEA for Electric Machine Design

1. Background of FEA for Electric Machine Design
    a. Evolution of FEA from 1970's to 2009
    b. Process flow: Input—Analysis—Output
    c. Typical purchasing and licensing arrangements
    d. Analysis choices
    e. Model creation & geometry considerations
    f. Materials issues
    g. Making the circuit model
2. Design methods, where FEA fits in
    a. Analytic and Reluctance models
    b. Model, Test, Model, Test
    c. Best practice for using FEA—where to start, where to go
3. How FEA is currently used, options, what to expect
    a. Geometry--Using built-in editor, links to CAD and Template import
    b. Materials—database, creating files
    c. Circuit— Using built-in editor, links to circuit simulators
    d. What you need to know, what you do not need to know
    e. What to expect for FEA learning curve
4. Evaluating the magnetic circuit Electric Machine Design using FEA, raw results
    a. Preparing input data, Current source vs. Voltage source
    b. Setting analysis conditions
    c. Evaluating output data
    d. Typical causes of inaccurate results
5. Parameters and performance simulation for machine design
    a. Back EMF
    b. Torque, Torque Ripple, Speed-Torque curve
    c. Copper and Eddy-current losses, Iron Losses
    d. Efficiency
    e. Inductances, Saturation

    f. Permanent Magnets & Demagnetization
    g. Mechanical torques, forces, motion
6. Moving to 3D and coupled physics FEA
    a. 3D extruded models
    b. 3D solid models
    c. Coupled physics analysis—Thermal for heating, temperature effects
    d. Coupled physics analysis—Structural for stress, forces, acoustics