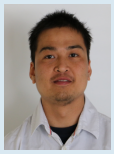

Huy Quoc Pham

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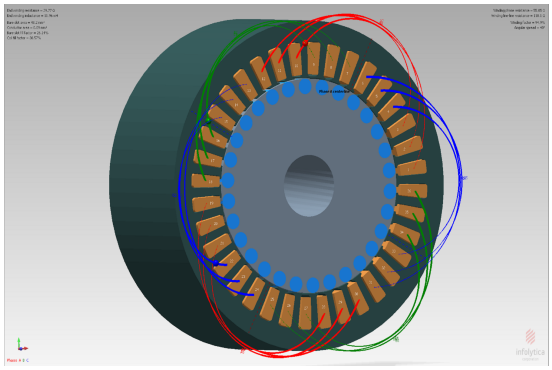
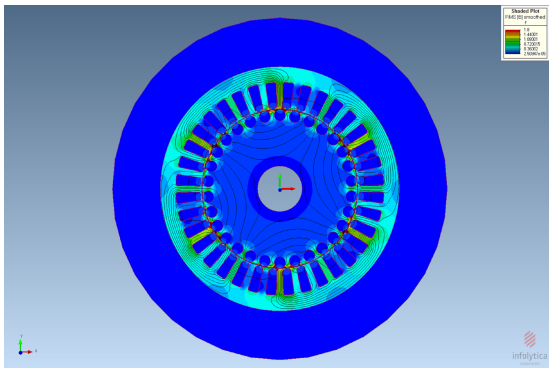
Students	Huy Quoc Pham, André Pick
Lecturers	Prof. Dr. Jasmin Smajic
Advisors	- -
Topic	Electromagnetic fields and waves

Simulation and Measurement of an Induction Motor

Asynchonous Machine Simulation with Finite Element Method



Initial MotorSolve model



Magnetic flux distribution in machine cross section

Actual stator and squirrel-cage rotor

Introduction: The operating behavior of an induction motor is determined by the design of the stator windings and the corresponding geometry. The parameters of an asynchronous machine can be calculated from the geometrical data of the windings and the magnetic core. These parameters can also be obtained by simulating the motor in tools like MotorSolve and MagNet. In this project an induction motor with a squirrel cage rotor as analyzed by Christaian Koster is simulated. The actual induction motor (300W, 400V, 50Hz, 1500rpm) is in the IET high voltage laboratory and is the main test object of this project.

Objective:

- The aim of the work is to create and simulate a 2D model of an induction motor with a squirrel cage rotor with the specified parameters and geometrical data of the windings and core. The simulation can then be compared to the analytical calculations and the tested measurements.
- In particular to perform a non-linear eddy current analysis of the motor and to calculate the following characteristics: 1. Torque as a function of speed. 2. Stator current as a function of speed. 3. Power factor as a function of speed. 4. Efficiency as a function of speed.
- Determine from the numerical field simulations the parameters of the equivalent circuit as a function of the rotational speed.

Result: With help from such simulations software it is possible to build and simulate virtual machines enabling numerous tests to be carried out and potential faults to be found which normally would have had to wait until the actual machine was built. The failure of an induction motor can result in severe damage not only to the motor itself but also to other related industrial equipment and devices. Taking this into account, motor simulation and fault diagnosis before the machine is built can save a lot of effort, reduce downtime, repair costs and increase the lifespan of these machines. The parameters provided by motor manufacturers are almost always obtained for starting and rated conditions and are not given for normal operating conditions. Whereas depending on the circumstances these parameters can change and need to be determined. For instance, stator and rotor resistance, magnetic saturation and inductance are all strongly affected by temperature changes. Therefore accurate motor parameter identification with simulation tools is of fundamental significance in motor research, offering relative simple, low cost and flexible solutions.