

Qualification test bench for the stator design of high power electric motors

Master thesis proposal 2019 – 2020, VUB MECH AVRГ

Atlas Copco is a world leader in the design and manufacture of efficient, high quality compressors for industrial use. The newest generation of these compressors are driven by powerful electric motors that rotate at high speeds (up to 10000 rpm) to generate the flow of compressed air. The design of these motors is tailored to each specific compressor to obtain the highest possible performance and efficiency. The design and development of such a motor presents many challenges in the fields of structural mechanics, thermo- and rotor dynamics and electromagnetics.



The focus of this thesis lies on the stator design. In a typical industrial motor, the stator is the hollow non-rotating part of the motor that contains copper windings to create a strong central electromagnetic field. This field drives the rotor with the required speed and power. In this thesis, the stator physics are studied using

analytical and numerical electromagnetic and thermodynamic simulations. The knowledge gained from these calculations will be used to define a stator qualification test. This test should indicate whether a manufactured stator performs according to the theoretical design, within specified margins of geometrical dimensions and material properties. The practical part of this thesis consists of the design and development of an accompanying test bench. The test bench should allow an engineer to measure the most important physical characteristics of the stator (temperature, losses, magnetic field strength, etc.) and compare the measurements with simulation results. The test bench should be easy to transport and operate, and be flexible to accommodate all the different stator sizes that are currently in use at Atlas Copco.

To summarize, the successful thesis applicant should reach the following objectives:

- Literature study on stator physics and modeling;
- Analytical/numerical model of the stator physics (electromagnetics and thermodynamics);
- Definition of a stator qualification test;
- Design and development of a stator qualification test bench.

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