Robust bearing lubrication nozzle design for high speed electric motors

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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 motor shafts are supported by bearings with rolling elements that must be lubricated with oil in order to run smoothly. The robust design of a nozzle that reliably sprays the oil onto the bearings presents some interesting challenges regarding manufacturability and lifetime. These challenges must be tackled to reach the high quality standards that are required by the industry.

In this thesis, the student will investigate different nozzle concepts for use in an oil bearing lubrication system. The concepts will be compared based on their performance (spray speed and accuracy) and especially on manufacturability (design complexity, required machining tolerances), robustness (material wear, risk of clogging) and serviceability (easily cleaned, replaceable). This comparison will be based on an extensive literature search, combined with CFD simulations of the oil flow through the nozzle.

Out of the different nozzle concepts, the most promising one will be selected and a proof-of-concept study will be performed on an experimental setup. The setup should allow for the measurement of the different nozzle flow parameters so that the numerical simulations can be validated. Preferably, the setup is to be designed such that different nozzles can easily be tested on the same platform. If time permits, this will allow for an optimization of the exact nozzle design by simulating and testing different nozzles.

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

- Literature study on different nozzle designs;
- Numerical model of the oil flow through a nozzle;
- Experimental validation of a selected nozzle design;
- Optimization of the nozzle geometry (optional).

Contact:
Wim.Devesse@vub.be
VUB Building Z – MECH, Room ZW1.21