

Cogging torque simulation focused on automated preprocessing

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INTRODUCTION

Cogging torque simulation focused on automated preprocessing

- Introduction
- Structure and capabilities of EaSync
- Improving the calculation of cogging torque
- The measuring rig
- Educational aspects

What is cogging torque?

- Cogging torque is normally an unwanted effect in synchronous machines with permanent magnets.
- It derives from the interaction of permanent magnets with the pole pieces in the stator.

$$T_W = l \frac{dW_{mag}}{d\alpha}$$

Bild: Polschuh magnet

- The change of magnetic energy W_{mag} stored in the machine leads to this effect.
- The rotor has preferred positions. It is similar to a bended spring which contracts after reducing the force, which bended the spring

How to reduce cogging?

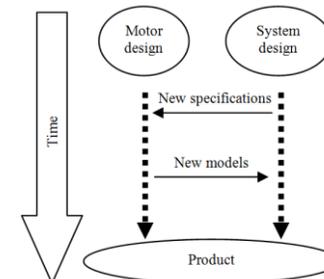
- Cogging torque can be reduced by:
 - improving the geometry of the Stator
 - improving the shape of the magnets
 - changing the magnetization of the magnets
 - choosing advantageous combination of poles and slots
 -
- To reduce the cogging torque effectively more than one parameter must be changed at the same time.
- This is a typical optimization task for FEA tools like Comsol Multiphysics and MATLAB Optimization Toolbox
- Unfortunately these tools are not coupled

Easync is...

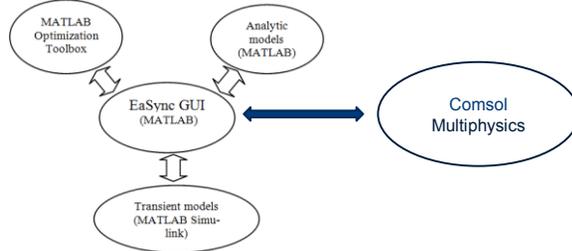
- a composition of „easy“ and „synchronous“
- a software tool being programmed at the Ostfalia University
- based on student research projects
- a growing expert system for designing synchronous machines from the scratch or improving existing designs
- based on COMSOL Multiphysics and Matlab

STRUCTURE AND CAPABILITIES OF EASYNC

Designing process of a mechatronic System with synchronous machine

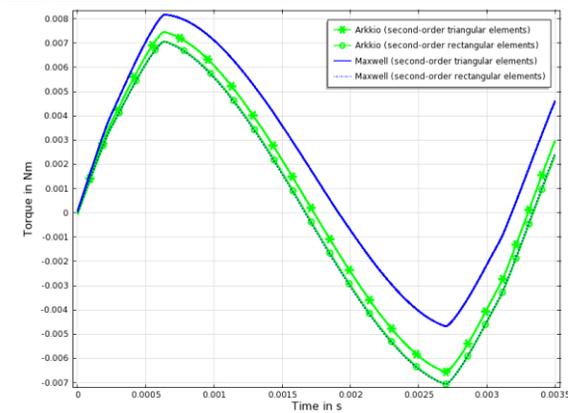
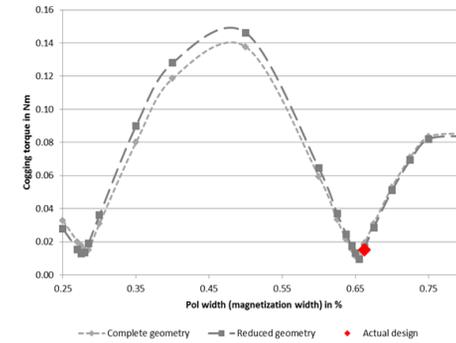


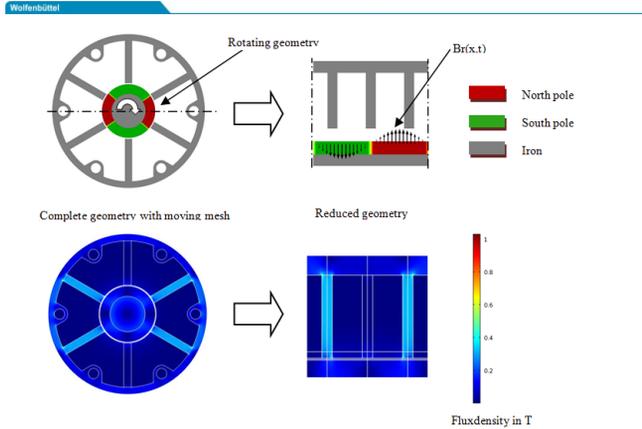
Structure of EaSync



IMPROVING THE CALCULATION OF COGGING TORQUE

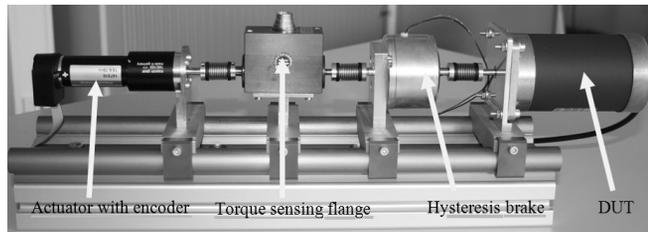
Optimization process using EaSync



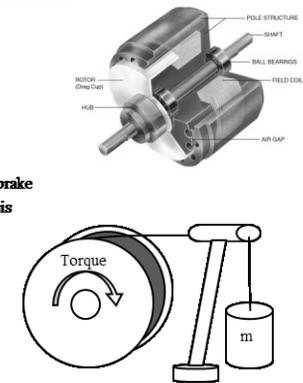
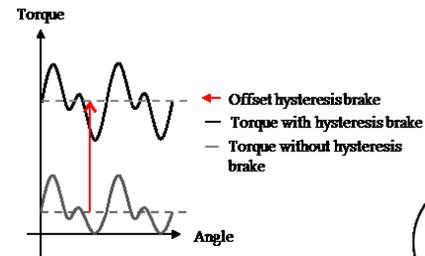


THE MEASURING RIG

The measuring rig



The hysteresis brake



Educational aspects

EDUCATIONAL ASPECTS

Ausblick

Thank you for your attention

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