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ENGINEERING

MONASH University

Faculty of Engineering
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Project Title: Eddy current loss analysis and mitigation techniques in high speed permanent magnet rotors

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Objective

The goal of this project is to develop methods for simulation of eddy current losses present in permanent magnet rotors and use these to analyse various mitigation strategies. The efficacy of these mitigation strategies will be evaluated in simulation, and time permitting, a prototype will be manufactured and tested to compare them.

Project Details

Electromagnetic materials are often conductive, resulting in parasitic eddy currents flowing. These eddy currents create unwanted losses, which reduces efficiency, but more importantly limits the performance of the machine. These losses are particularly important in rotors, as they are typically a lot more difficult to cool.
There are several techniques you can use to reduce these losses, however typically this also increases manufacturing effort and cost, and sometimes also the weight of the assembly.

Due to the highly nonlinear nature of the core material and the high frequencies involved, there are skin effects which depend on the conductivity and permeability of the material, which makes problems of this nature complex to solve. Finite element analysis will be used to investigate an existing design, simulating magnetic field distributions to evaluate eddy current losses induced during operation.

Validation of these losses also presents challenges due to the relatively low loss present in the rotor (as opposed to the stator) and the degree to which losses can be accurately measured. This validation will be completed with support from post-graduate students on a state of the art motor testing facility in the Power Engineering Lab.

Prerequisites

Experience with electromagnetic theory / magnetic materials.
Experience with ANSYS Maxwell or similar (Electromagnetics FEA)