



RARE-EARTH MAGNET-FREE ELECTRIC DRIVE ALTERNATIVES: THE CASE OF VARIABLE PHASE-POLE INDUCTION MACHINE DRIVES

Electric machines and drives are the crucial components in the global electrification movement that we are living in. Almost all global electricity is generated through electric machines, and nearly half of it is consumed by electric machines. In this context, the environmental sustainability and recyclability of electric machines and drives have risen as societal issues.

In the case of electromobility, vehicle manufacturers are struggling to find suitable drive solutions that fulfill the application requirements (very high torques for low speeds and low torques for very high speeds) while keeping adequate energy efficiency and a reasonable ecological footprint in large-scale manufacturing. Rare-earth magnets represent a critical element in these drives. While enabling high levels of power and torque density, these magnets are not exactly environmentally friendly and recyclable, and they also raise concerns for the unstable supply chain and the possible impact on the global economic/political landscape.

Therefore, an intense research activity aims to find rare-earth magnet-free drive alternatives for electromobility applications. Among the different solutions are ferrite magnet-based synchronous machines, wound-field synchronous machines, hybrid synchronous machines, variable flux synchronous machines, and more. A class of machines that is relatively undeveloped is the variable phase-pole induction machines, which are essentially multiphase induction machines with the capability of electronically changing the number of pole pairs in real-time.

This seminar will try to make a case for the variable phase-pole machines, discussing their advantages and drawbacks. There will also be an insightful discussion on how to operate variable phase-pole drives, answering the following questions:

- How do we model and control a multiphase induction machine?
- How do we extend the modeling and control approaches to a variable phase-pole machine?
- How do we practically build a variable phase-pole drive?
- What constraints should we consider when switching the number of pole pairs?
- How do we compare their performances to synchronous machine counterparts?
- ...and many more questions that may appear along the way.

SEMINAR

Wednesday, July 5th 2023, 14:00 – 16:00

Orange Meeting Room, DPIA, UniUD



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