

ELECTRICAL, ELECTRONICS AND COMMUNICATIONS ENGINEERING

Diplomatic - Development of a toolchain for the characterization and control of synchronous reluctance motors

Funded By	DIPLOMATIC OLEODINAMICA SPA [Piva/CF:05933050964]
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Context of the research activity	<p>Industrial motor systems account for a large portion – about 40% – of electric energy use, globally. Synchronous reluctance motors (SynRMs) meet ultra-high efficiency standards without relying on rare-earth permanent magnets, thereby reducing cost of replacement of lower efficiency legacy motors and avoiding supply chain uncertainties. Despite these advantages, the widespread adoption of SynRMs is limited by the complexity of their control, especially across a wide range of power ratings, stemming from the need for off-line individual identification of the motor flux linkage curves. In this context, Diplomatic MS S.p.A. is developing a comprehensive toolchain to support the design, optimization and qualification of SynRMs control strategies across a wide power range. The goal is to overcome current limitations and enhance their industrial adoption.</p>
Objectives	<p>This doctoral project focuses on developing a systematic framework for the design and control of synchronous reluctance motors. The key objectives include:</p> <ul style="list-style-type: none">- Experimentally validating the motor under test by analyzing flux and torque characteristics;- Creating a universal, self-calibrating sensorless control strategy that can adapt to different motor designs, with emphasis on achieving high-bandwidth dynamic performance;- Developing self-commissioning techniques for automatic mapping of motor characteristic;- Implementing Hardware-in-the-Loop (HiL) simulation models to enable real-time testing and validation of different motor designs. <p>This PhD research will be carried out in collaboration between the Power Electronics Innovation Center (PEIC) at Politecnico di Torino and Diplomatic MS S.p.A. The open-source platform SyR-e will be the reference software tool of work.</p>

**Skills and
competencies
for the
development of
the activity**

Key requirements for this PhD project are:

- holding a master degree in electrical engineering or related fields;
- demonstrating an excellent knowledge of the design and control of synchronous motor drives;
- having strong experience with simulation environments and real-time control development;
- excellent knowledge of English language;
- ability to work in a team, curiosity, and willingness of exploring novelty and withstand uncertainty.