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Non-binding Master Thesis Proposal

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Data-Based Modelling of Electric Drives for Reinforcement Learning-Based
Controller Design

Schedule Starting October 2025 with duration of six months.

Background:

The performance and efficiency of electric drives are fundamentally determined by their control methods and modulation schemes. While conventional approaches rely on simplified models and control structures, these limitations often restrict optimal performance in real-world applications. Reinforcement Learning (RL) has emerged as a promising solution, offering the potential to enhance performance through more sophisticated models and control structures, e.g., direct switching control which directly manipulates the switching time instants of the inverter terminals. However, RL agents trained in simulation environments using simplified models frequently experience performance gaps when deployed in real-world scenarios.

Objective:

The main objective of this thesis is the development of an innovative electric drive model suitable for a direct switching controller design using reinforcement learning.

Tasks:

- Literature review on data-based modelling and control of electric drives.
- Development of a concept for electric drive system excitation for generating training data capturing the switching behavior.
- Development of an electric drive model that captures the switching behavior using physics-based and data-based modelling techniques.
- Optional: Training and evaluation of a direct switching controller using reinforcement learning and the developed models.
- Documentation of work.

Yours sincerely

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