

Master project, 2024-2025

Modelling and Control of Multi Three-Phase Drives for Transportation

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Context

This internship is proposed in a context of a strong development of e-mobility such as electric cars, motorsport formula E, electric flying vehicles (also known as “eVTOL”), more electric aircraft... for the future generation of transportation. This internship proposes to model and control of an electrical drive built from a Multi 3-phase machine ($k \times 3$ -phase) to achieve the modularization and increase the functional reliability.



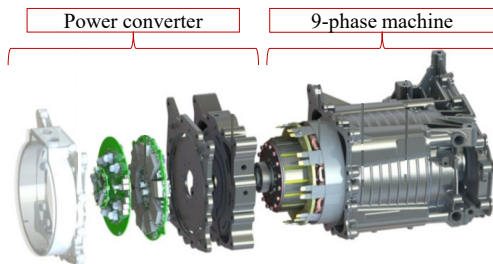
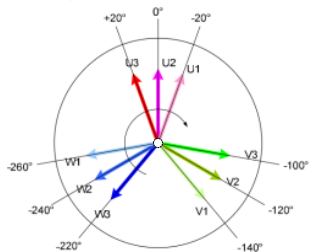
E-Formula example



CityAirbus, an eVTOL example

Objective

Develop control strategies for a Multi 3-phase drives in normal and faulty modes (phase opened or open-switch of the inverter). Two main topologies will be considered: **2x3-phase machine** and **3x3-phase machine**. Due to a higher Degree of Freedom comparing to a traditional 3 phase machine, it should be interesting to define the **optimization** such as torque maximized, and losses minimized.



Work steps

- Bibliographic analysis on the subject.
- Modelling and control of a Multi 3-phase machine
- Fault-tolerant control and simulation with Matlab/Simulink software
- Experimental tests in L2EP Lab. with a 2x3-phase machine.

Key word

Modelling, Dual-three phase machine, Multi 3-phase machine, Fault Tolerant Control, Optimization, Matlab/Simulink

References

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2. W. Zhang, N. K. Nguyen, E. Semail, and Y. Xu, "A New Harmonic Current Control Approach of Dual Three-Phase PMSM in Degraded Mode," in *IECON 2023- 49th Annual Conference of the IEEE Industrial Electronics Society*, 16-19 Oct. 2023 2023, pp. 1-6, doi: 10.1109/IECON51785.2023.10312561.
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