Online Course Development for eVehicle Motor Control.

THUAS Delft, The Netherlands
P.J. van Duijsen(presenter), D.C. Zuidervliet

dc-lab.org

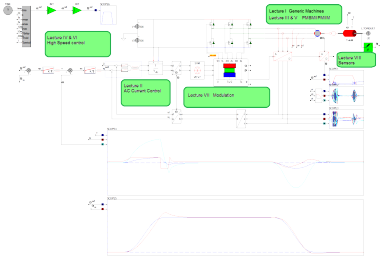
Mai 24 , 2024

Table of contents

Introduction

Task:
eMobility & Electric Driveline and Control

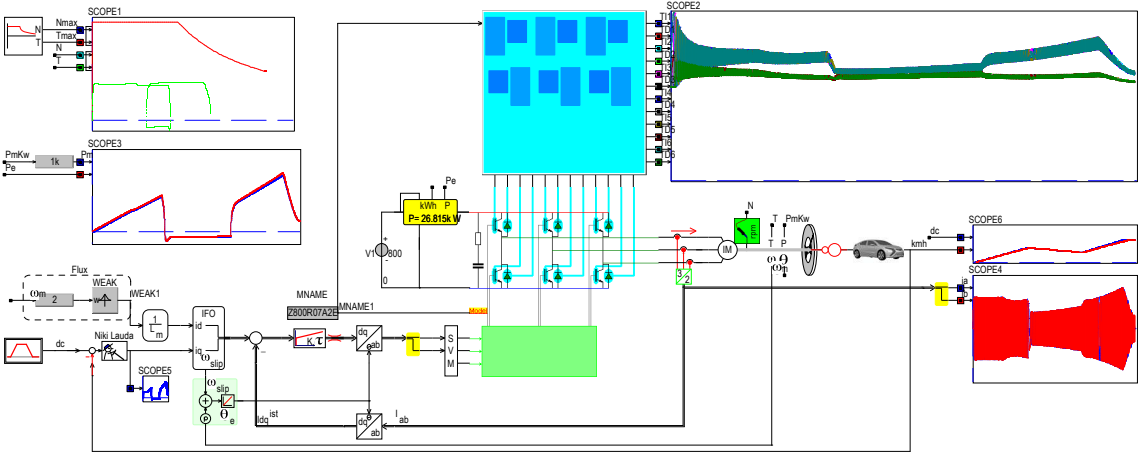
- Driveline design
- Field Oriented Control
- IPM control
- Experimental assignment



Control Design

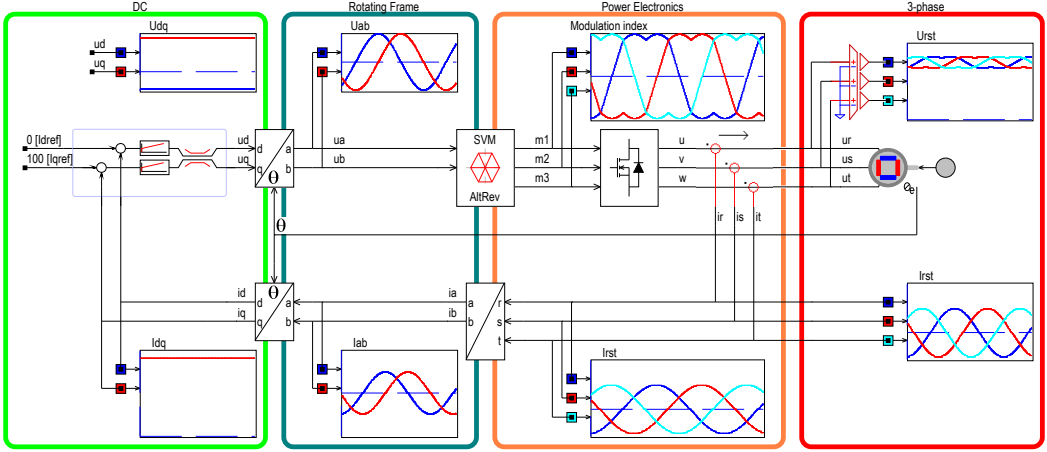
Design Tools & Simulation & Hardware Trainer

Design of the electric driveline



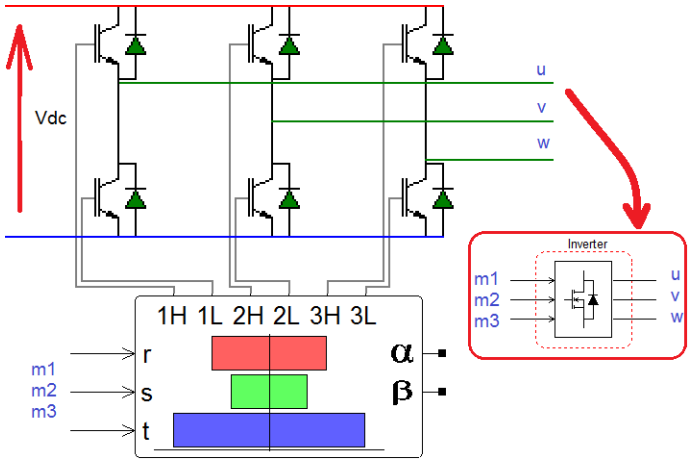
Simulation of the control and losses in an electric vehicle with interior permanent magnet synchronous machine and Field-Oriënted Control in Caspoc

Field Oriented Control



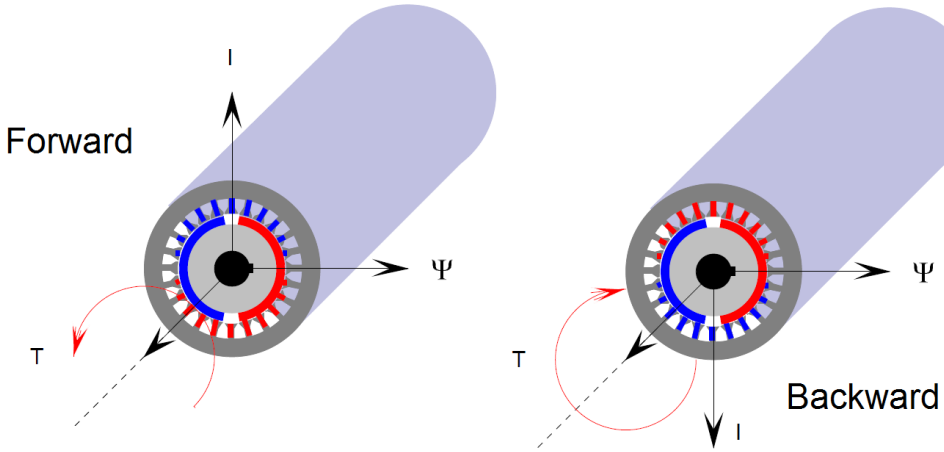
Field Oriented Control of a PMSM machine explained using a simulation in Caspoc

Power Electronics inverter and Modulation



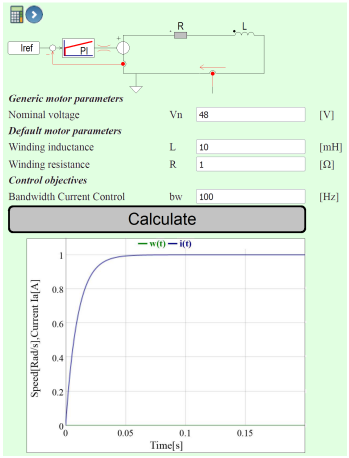
Inverter represented by a single functional block and by a detailed animated block, that can be both used in the simulation in Caspoc, depending on the level of detail required.

Torque production with FOC



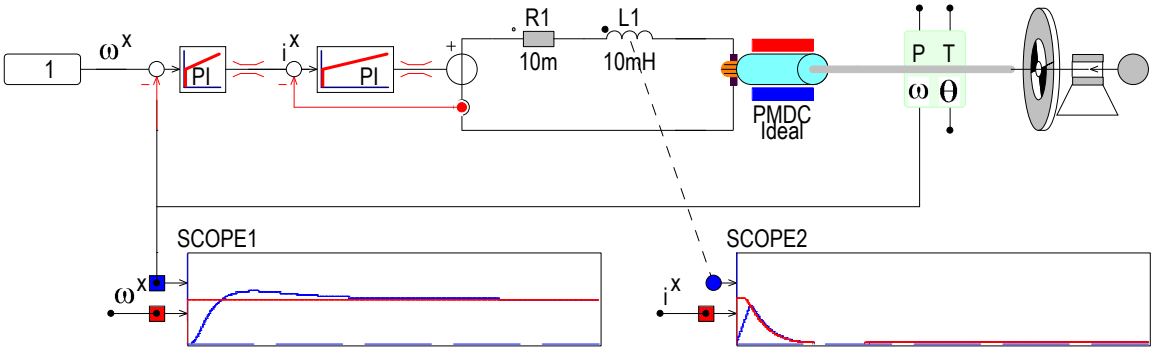
Forward or backwards rotation controlled by I_{dq}

Basics of Cascaded Control:Current Control



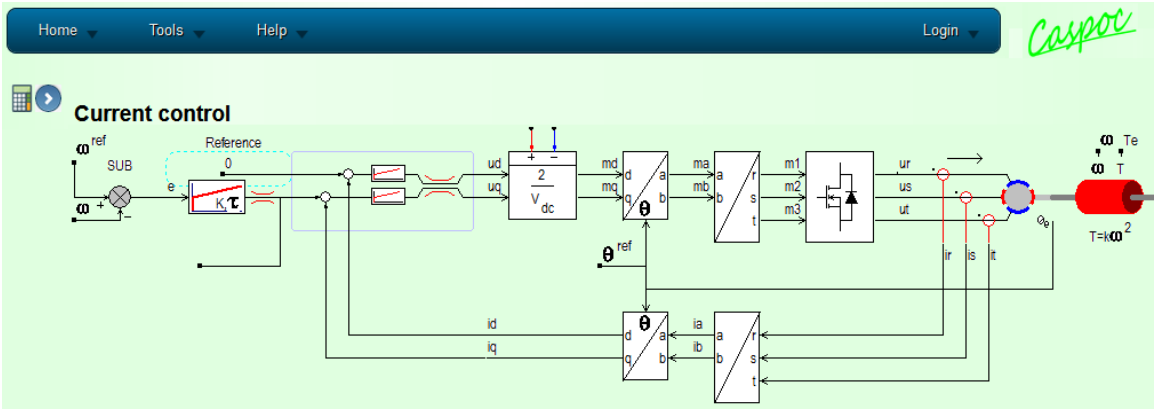
Current control of an RL load using a PI controller.

Basics of Cascaded Control:Speed Control



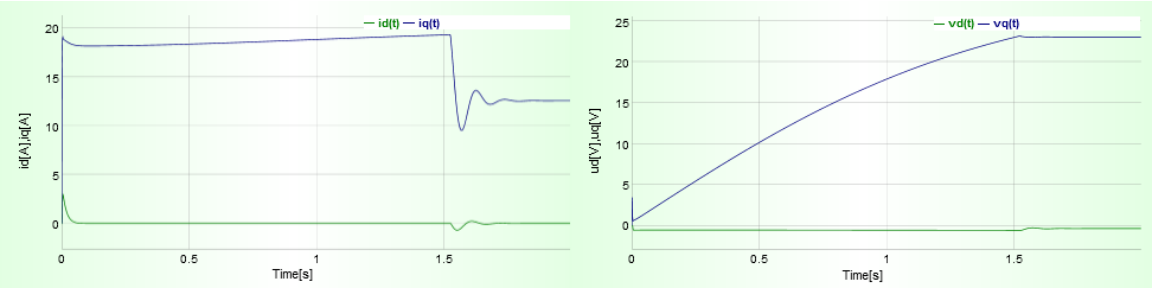
Cascaded speed-current control of a generic machine.

Cascaded control of an PMSM



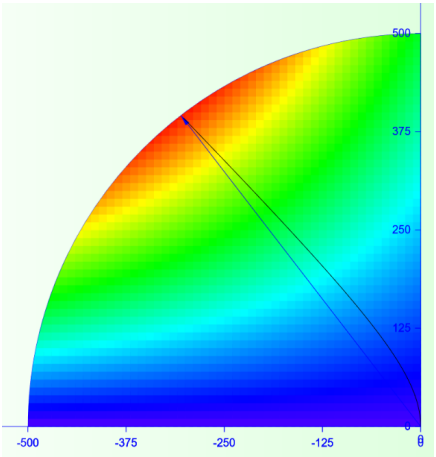
Current control of an Interior Permanent Magnet Synchronous Machine using two cascaded PI controllers.

PI control design



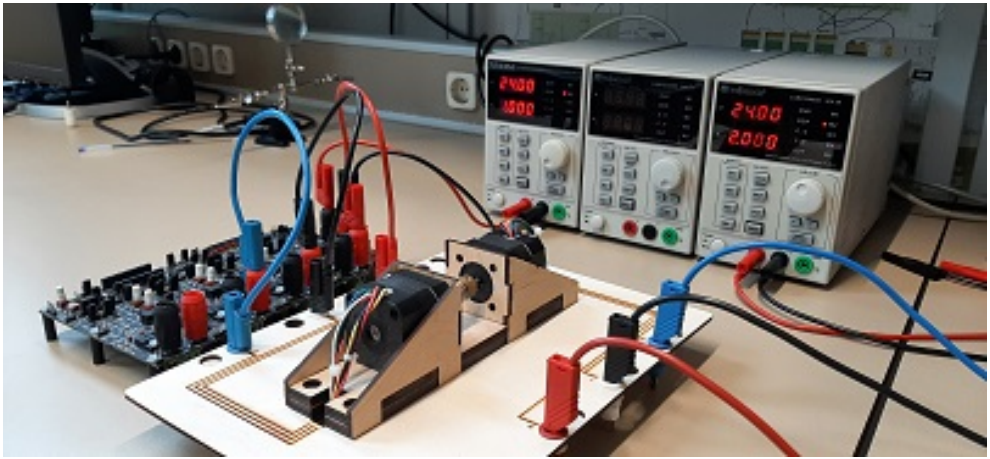
Voltage and current of the field oriented control, for the Interior Permanent Magnet Synchronous Machine using two cascaded PI controllers.

Field Weakening



Normalized Torque as function of i_{dq} in an IPM.

Experimental laboratory set-up



Laboratory setup for measuring voltage, current, torque and speed of two coupled AC motors powered by a Universal Four Leg

Conclusion

- Drive Line design and Cascaded Speed-Current control
- Field Oriented Control & Field Weakening
- Design tools and Simulation
- Hardware Trainer

Thank you!
https://www.dc-lab.org
P.J.vanDuijsen@hhs.nl