
Master project, 2017-2018

— Initial Rotor Position Detection for Sensorless Control of Multiphase PMSM Drive —

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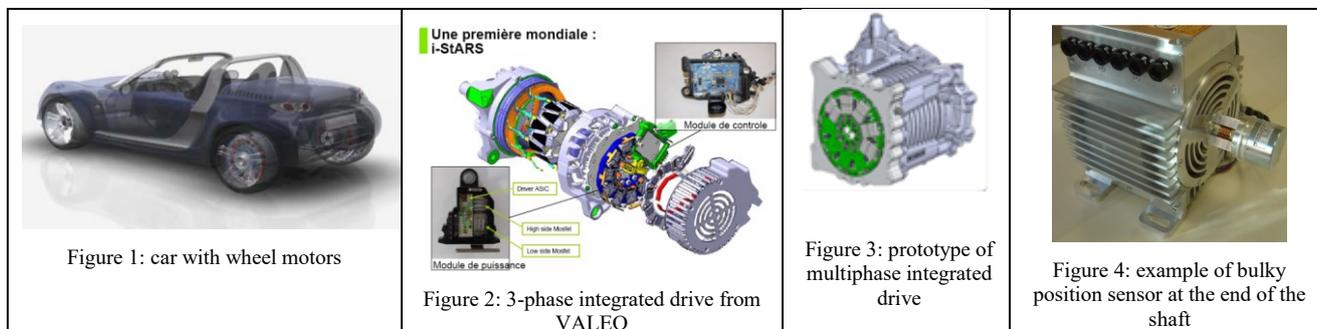
Context

Multiphase drive based on Permanent Magnet Synchronous Motor (PMSM) has received considerable attention in several industrial applications but a major drawback is the higher number of external connections and inverter-legs. In the Emerging Integrated Drive (Power Converter inside the machine), this drawback is disappearing: the number of phases becomes a parameter for the design optimization.

But with the integration of the power converter, the space taken by the mechanical position sensor is now a problem for the integration. As consequence "Sensorless" control, without mechanical position sensor, is of the highest interest. As multiphase machines have specific properties in comparison with classical three-phase ones, specific observers of the position can be imagined.

In sensorless control, the estimation of the position at low and zero speed is essential. Especially at startup of the machine, the initial rotor position is necessary in order to produce by vector control, a torque with minimum losses.

Initial rotor position detection methods are well investigated and well known for classical three-phase drives. The major challenge is to be able to impose voltages to the machine without producing torque. High frequencies signals are commonly used.



Objective

This work is focusing on the problem of estimation of the initial rotor position in an existing 5-phase PMSM drive (figure 4). A specific algorithm for the initial detection will have to be imagined and tested. The specificity is based on particular properties of multiphase machines in comparison of three-phase machines.

Work steps

- Bibliography project about initial rotor position detection strategies for three-phase and multiphase drives
- Scientific project on high frequency voltage injection for initial rotor position detection for 5-phase PMSM. Simulation (Matlab/Simulink)
- Internship: comparison between simulation and experimental results (Matlab/Simulink, dSPACE/OpalRT)

Key word

Multiphase drives, PMSM, rotor position detection, Signal processing, high frequency voltage injection.

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