

Predictive Stator Flux and Load Angle Control of SynRM Drives for the Full Speed Range

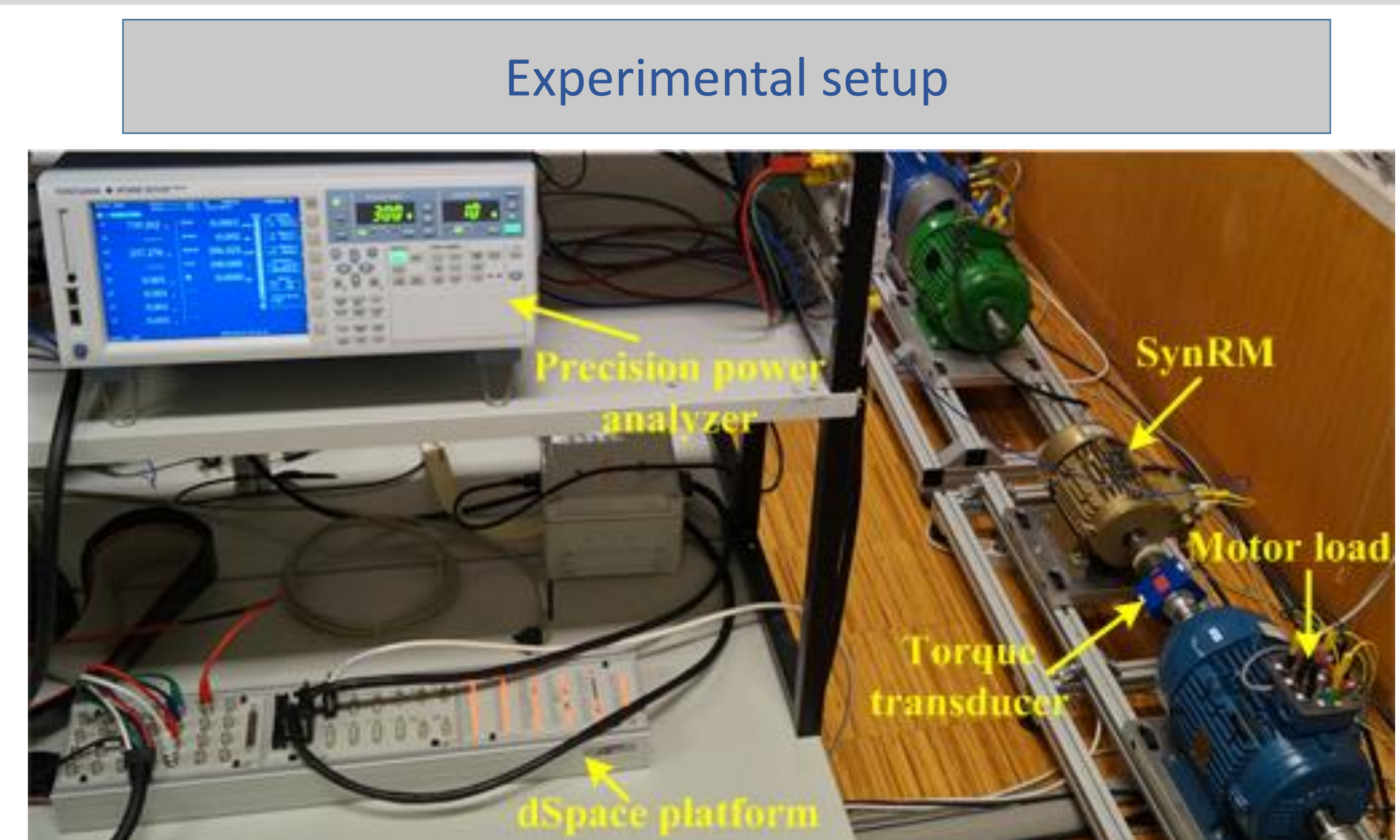
Power Systems

Background and challenges

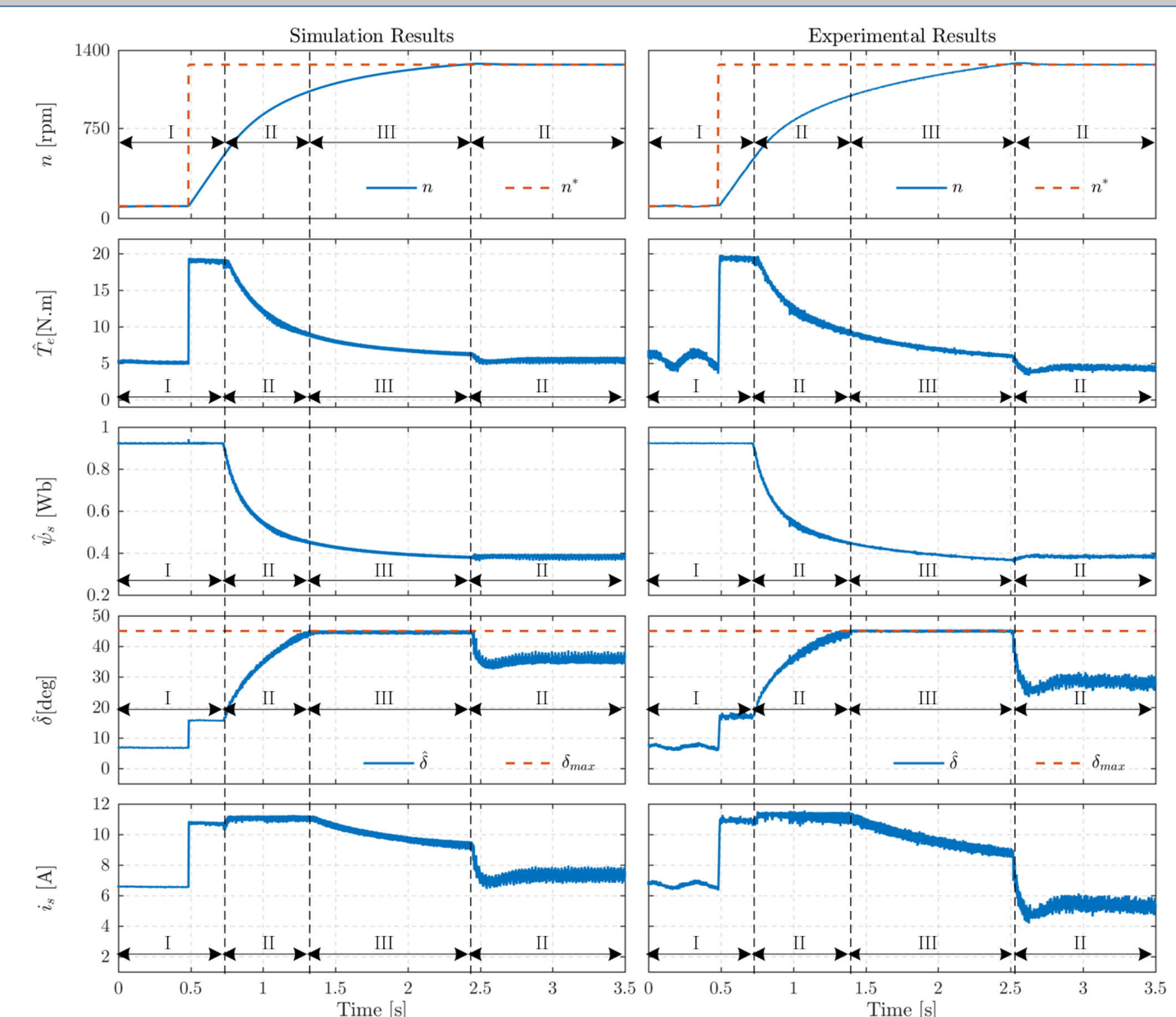
- SynRMs have a simple structure, are robust, and have a low cost due to the absence of permanent magnets or windings in the rotor.
- Model predictive control (MPC) is a promising alternative control strategy to FOC and DTC.
- The most popular type of MPC is finite control set model predictive control (FCS-MPC).
- FCS-MPC limitations: large amount of calculations, selection of the weighting factors used in the cost function, and it has not been investigated to properly control SynRM drives in the full speed range.

Description and main innovation

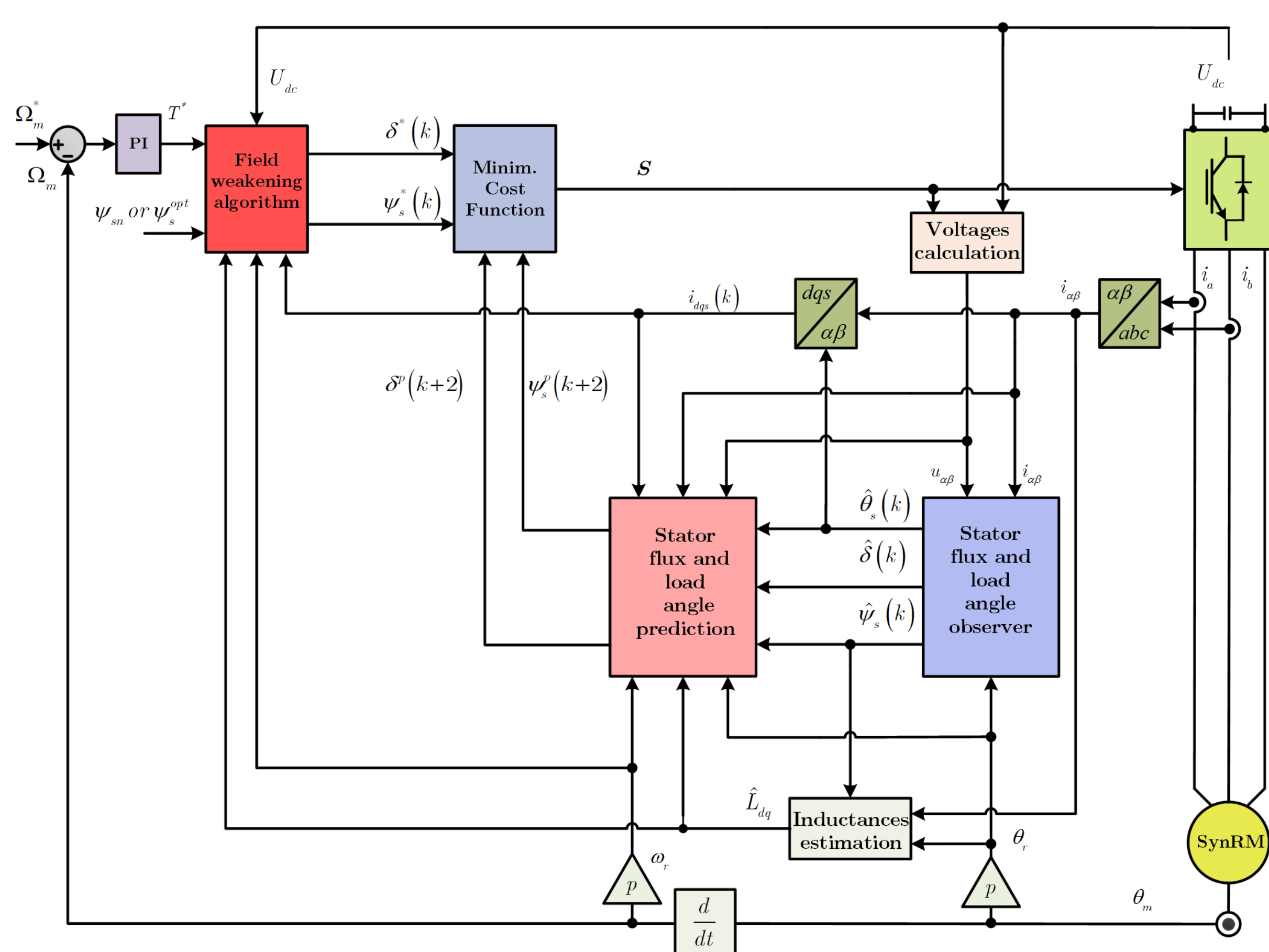
- Development of a new FCS-MPC system for SynRM drives which regulates directly the load angle and the stator flux amplitude.
- Smaller computation time.
- Simple cost function, no weighting factors to tune!
- The transition between the different operating regions of the drive are smooth and straightforward.



Acceleration of the SynRM from 100 rpm to 1280 rpm with a load torque of 5 N.m



Proposed control scheme for SynRM drives



Achievements

- ▶ H. Hadla and S. Cruz: "Predictive Stator Flux and Load Angle Control of Synchronous Reluctance Motor Drives Operating in a Wide Speed Range" *IEEE Trans. Industrial Electronics*, vol. 64, n°9, pp. 6950-6959, Sept. 2017.
- ▶ A. Varatharajan, S. Cruz, H. Hadla and F. Briz: "Predictive torque control of SynRM drives with online MTPA trajectory tracking and inductances estimation", Proc. IEEE International Electric Machines and Drives Conference, Miami, FL, USA, May 21-24, 2017.
- ▶ H. Hadla and S. Cruz: "Active flux based finite control set model predictive control of synchronous reluctance motor drives", 18th European Conference on Power Electronics and Applications (EPE'16 ECCE Europe), Karlsruhe, 2016, pp. 1-10.