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2021/04/06

Student Project
(BA, MA, HS, FP, Projekt angewandte Forschung, etc.)

Analytic computation of optimal feedforward torque control strategies

The LMRES research group investigates optimal control strategies for highly nonlinear synchronous machines. Recently, an optimal feedforward torque control (OFTC)-strategy was introduced; the strategy takes into account copper and iron losses as well as nonlinearities which are caused by magnetic saturation and cross-coupling effects. Instead of the well known maximum torque per current (MTPC) operation strategy, maximum torque per losses (MTPL) is realized. In order to apply this strategy, a fourth-order polynomial (quartic equation) needs to be solved. This can be done analytically; however, there are different algorithms which differ in complexity. This student work studies different analytic algorithms for solving a fourth-order polynomial for OFTC-strategies.

This project covers:

- State of the art solving fourth-order polynomials analytically.
- State of the art solving fourth-order polynomials numerically.
- Implementation of proposed algorithms.
- Developing an extended algorithm for solving fourth-order polynomials with focus on OFTC-strategies for non-linear anisotropic synchronous machines, e.g. PMSM, RSM.
- Simulative validation and comparison using Matlab & Simulink.
- Experimental validation and comparison using LMRES machine lab's realtime system.

For questions and application contact Niklas Monzen (niklas.monzen@hm.edu).