Multistep Model Predictive Control of Induction Machines and 3 Level-NPC with DC-Link Balancing

Abstract:
This thesis presents different novel concepts for computationally efficient multistep model predictive electric drive control. The drive consists of an induction machine and a three level-neutral point clamped (NPC) inverter. In order to control this inverter it is necessary to keep the DC-link voltage balanced. Therefore a nonlinear mixed integer optimization problem has to be solved. After developing a multistep prediction model for the neutral point voltage this thesis presents three different computationally efficient solutions to the corresponding optimization problem: 1) A priori state selection which uses a reduction of the inverter states taken into account. 2) Linearization of the nonlinear prediction model and 3) Design of a nonlinear branch-and-bound (called nonlinear sphere decoding) algorithm. Afterwards the methods are compared by means of MATLAB/ SIMULINK simulations.

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