Predictive Cascaded Speed and Current Control for PMSM Drives with Multi-time Scale Optimization

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Abstract—This paper proposes a predictive speed and current control with multi-time scale optimization in a cascade architecture for permanent magnet synchronous motor (PMSM). Considering the difference of time scale characteristics for speed loop and current loop, different sampling times are assigned to respective subsystem. In the prediction step of conventional two-time scale system, the coupling between slow and fast sampling models is ignored and the output of slow-sampling model at asynchronous sampling period is missing, which both weaken the prediction performance of system. In this paper, the predictions of both slow and fast model for all the prediction instants are analyzed in detail. Besides, a linear estimation method based on virtual instants is proposed to improve the performance of slow-sampling model for fast prediction instants. The data stream of proposed method is designed based on the cascaded structure. The strategies are implemented on a field programmable gate arrays (FPGA) taking advantages of parallel and pipeline processing techniques. Experimental results shows that the proposed strategies have a better dynamic performance compared to the conventional method.

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