Dynamic Performance of a Speed Sensorless Induction Motor Drive with Flux Weakening Operation

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Abstract— The paper is concerned with the operation in dynamic regime of an induction motor drive operated into deep flux weakening operation. Based on the induction motor's mathematic model, an algorithm for sensorless direct flux vector control (SDFVC) was implemented. The control schematic for SDFVC is described. The stator flux amplitude is controlled by the d_s axis voltage component, while the load angle (and thus the torque) is regulated by the q_s-axis voltage component. The proposed algorithm is suitable for low cost induction motor drives where accuracy in the speed estimation is not mandatory and is based on a closed-loop stator flux observer. The vector control block is realised with two PI regulators, the output of this regulators being the reference voltages in the stator coordinates oriented along the stator flux. The authors studied the behavior of a drive system in the field weakening zone, in order to get a maximum torque considering the limitations imposed to currents and voltages. The system was also tested in transient regimes of acceleration and deceleration, the stationary regime being studied too. The experimental data gathered during the accomplishing of the drive system tests when the control algorithm was employed are presented and discussed in the end. The tested three phase induction motor has a power of 4 kW.