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DEADBEAT RESPONSE OF TORQUE-FLUX BY WEIGHTING FACTOR ELIMINATION IN FINITE-SET MODEL PREDICTIVE CONTROL OF INDUCTION MOTOR DRIVES

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Abstract. Reduction of torque and flux ripples in Finite Set Model Predictive Direct Torque and Flux Control methods (FS-MPDTFC) has been currently acquiring an especial attention in the field of electrical drives throughout the world. Employing two or more number of voltage vectors instead of one voltage vector at each control period significantly reduces both the torque and flux ripples. Also, the ripple in these methods severely depends on the rules employed to control the electrical torque and stator flux. The daedbeat solution can be employed for both torque and flux in two recent decades. Because, this technique satisfies null error for torque and flux at the end of each sampling time. In this paper, a new daedbeat response of torque and flux is introduced in the field of FS-MPDTFC. After reducing the candidate voltage vectors to three vectors based on the proposed method, prediction is performed in two stages. In the first stage, the first voltage vector is selected through the flux prediction. Then, the second optimal voltage vector is selected by evaluating the cost function of electrical torque in the second stage. Also, the time duration of the first and second vectors has been calculated based on the deadbeat response of torque and flux. Consequently, the challenge of determining the weighting factor is obviated. Furthermore, a kalman filter with new state variables namely stator and rotor currents is employed to estimate the motor variables. Both the simulation and experimental results have confirmed the effectiveness and superiority of the proposed method.

Keywords. Daedbeat Control, Induction Motor, Torque and Flux Ripples Reduction, Time Duration

1 Introduction

In contrast to Field Oriented Control (FOC), Switching Table based Direct Torque Control (ST-DTC) has the prominent merits such as: rapid control of electrical torque and stator flux, simple structure of controller, high robustness against the parameter changes and external load disturbance, direct control of torque and flux using the basic voltage vectors of inverter, and employing in the stationary reference frame [1, 2]. Apart from these advantages, high torque-flux ripple and variable switching frequency are two major drawbacks of this method. Hence, space vector modulation based DTC (SVM-DTC) has been presented to overcome these problems. In this