CONSTANT MRAS SPEED AND STATOR ESTIMATION FOR AN EFFICIENT DEADBEAT CONTROL OF INDUCTION MOTOR

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May 3, 2018

Abstract

In this paper another sensorless miscreant control technique is proposed. In miscreant technique, the coveted voltage is figured by means of the model of the enlistment engine and inverter (expectation show). This voltage incites the engine to track the references of the torque and motion in the following control interim. Strength is an imperative issue about the bum strategy. Two new strategies are utilized to achieve a vigorous speed-free sensorless bum strategy. A speed free model is sued for forecast. Along these lines, the evaluated speed won’t be utilized as a part of the expectation show. It will diminish the float mistake issue. Likewise, another versatile prescient technique is proposed for synchronous estimation of the stator protection and speed. Just immediate pivot condition is utilized as a part of the versatile technique. This will decrease the figuring load. The new versatile capacity is accomplished through Lyapunov strategy. The strength of the MIMO framework for synchronous adjustment is broke down for the pick up outline issue. Reproduction and test brings about extensive va-
riety of speed are delineated so as to confirm the proposed technique.

**Key Words:** Predictive control, deadbeat control, sensorless control, robust model

1 **INTRODUCTION**

There is a growing inclination to utilize sensorless drives for air conditioning engines in light of the fact that the speed sensor builds the mass and the cost of the drive framework on one hand and lessens the heartiness of the framework then again. As far back as the immediate torque control (DTC) strategy has been presented in 80s, numerous mechanical applications use this technique on account of sensorless intrinsic of it [1]. DTC strategy is particularly more wanted in the enterprises in which torque control is more critical than the speed control, e.g., the footing, paper, and steel ventures. Moreover, the quick powerful reaction of the torque and low calculation burden, which are attained because of direct normal for this strategy, presents the DTC as a successful and pragmatic sensorless technique [2]. Lately prescient torque control (PTC) has been examined in a few investigates as the created DTC strategy. Prescient control may enhance the consistent state reaction of the DTC while the quick powerful reaction is kept. Different kinds of PTC are researched to date. Among them the limited control set model prescient control (FCS-MPC) technique [3] and miscreant control has been more researched [4], and [5]. FCS-MPC depends on foreseeing the coveted voltage which limits the recommended cost work [6,17]. The cost work needs to speak to the mentality of the controlled states (the torque and motion). The practical data sources are inspected in the cost work. The ideal choice is the limiting one. This technique is broadly researched in the most recent decade. As a result of the nearness of the cost work, the coveted control criteria could be effortlessly added to the plan. In spite of the fact that FCS-MPC is straightforward and successful, there are downsides about it which are as yet staying open inquiries.

The principal disadvantage is high torque swell as a result of utilizing direct vector exchanging. In [7,15], an internal balanced FS torque control technique is proposed. A linearization for consolidating the limited set and the tweak strategies is utilized as
a part of [7]. A present sounds diminishment strategy in view of FCS-MPC is presented in [8,16]. Three-level inverter is utilized as a part of [9,18] that the straightforward normal for FCS system is utilized for nonpartisan point voltage decrease.

The second disadvantage is tuning weighting factor. A few examinations are performed to take care of the issue. Disconnected inquiry strategy [10] is the most common procedure. Online figuring techniques are proposed in [11] and [12]. In [13], isolated cost capacity and mean rank estimation is utilized rather than one cost work. Be that as it may, the weighting factor is as yet an open inquiry. Prescient current control is another system in which the weighting factor isn’t fundamental [14,19].

The third disadvantage is the quantity of calculations for the cost work particularly in cases that the cost work comprises of additional and convoluted terms or the multilevel inverter is utilized. In [15] and [16], doable VVs (voltage vectors) are limited keeping in mind the end goal to lessen the calculation trouble.

2 SPEED INDEPENDENT SENSOR-LESS DEADBEAT PTC

All deadbeat methods are based on calculating the desired input which impels the output to reach its reference value in the next control interval. The calculation of the desired input is accomplished by means of the discrete model of the system. Regarding deadbeat predictive torque control, the desired voltage has to be calculated in order to drive the motor to the reference values of the torque and flux. If the intent is eliminating the speed from the prediction model, the both equations for the torque and flux prediction have to be speed- independent.

3 PREDICTIVE ESTIMATION OF THE SPEED AND STATOR RESISTANCE

Since the temperature rises during the application of the motor, so do the resistances of the stator and rotor. The method is more sensitive to the change of the stator resistance compared to that of the
rotor resistance at low speeds. This conclusion has been come by investigating the simulations. On the other hand the speed should be estimated for the speed controller. Although the estimated speed will not be used in the proposed deadbeat prediction model but the stability of the speed control is dependent on the speed estimation especially in low speed. In order to compensate the stator resistance variation and stable and accurate speed estimation, a predictive adaptive method is proposed. In this method, the model reference adaptive system (MRAS) is utilized to simultaneously estimate the stator resistance and the rotor speed.

![Predictive MRAS system for stator resistance estimation.](image)

**Fig. 1.** Predictive MRAS system for stator resistance estimation.

## 4 CONTROLLER AND MODEL GAINS ASSIGNMENT

The coefficients of the proposed predictive adaptive method for the resistance and speed estimation have to be tuned in order to achieve the most feasible stability and good dynamic performance. The reference model of (12) has been used in [4] only for the stator resistance estimation. In this paper that reference is used for the resistance and speed estimation. In [7], a method of gain assignment for simultaneous resistance and speed calculation is proposed. In this paper, the direct axis stator current is used. Therefore, there is only one real gain in the adaptive predictive model. Furthermore, the calculation burden is reduced impressively. Totally, there are five coefficients to be tuned by taking the coefficients of two regulators into account. The pole placement method is utilized for gain calculation in this paper. The poles of the MIMO system for the resistance and speed estimation should be stable.
5 RESULT

In order to verify the proposed sensorless deadbeat PTC method, simulation and experimental results are presented. The two-level VSI and SVM switching method are utilized for exerting the calculated voltage. The control interval duration is set to 100s.

![Fig.2.Mode 1](image)

6 CONCLUSION

A new approach for sensorless deadbeat control of induction motor has been proposed. In the proposed method, the desired voltage prediction is performed by a speed independent model. Therefore, the predictive scheme will not be sensitive to speed estimation error. The lag of the rotor flux oriented frame is compensated by a predictive position estimation technique. This prevents the torque to be deviated from the set point. On the other hand, in order to compensate the sensitivity of the deadbeat control the stator resistance is adapted in the model. Also the speed is adaptively estimated for the speed control loop. A new model for simultaneous estimation of the stator resistance and the speed is used. The gains of the MRAS technique is calculated via the stability analysis. The MRAS method is applied in a predictive form. This reduces the drift error that is a common problem in MRAS methods. Simulation and experimental results verified the proposed method. The results showed that the method is stable in wide band of the speed. Also, they showed very fast dynamic responses which are caused by the characteristic of the deadbeat control.
References


