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Full and Reduced Order Extended Kalman Filter for Speed Estimation in Induction Motor Drives: A Comparative Study

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Summary

This paper presents a comparative study between a new approach for robust speed estimation in induction motor sensorless control, using a reduced order Extended Kalman Filter (EKF), and the one performed by the full order EKF.

The new EKF algorithm uses a reduced order state-space model that is discretized in a particular and innovative way, proposed in this paper. In this case, only the rotor flux components are estimated, besides the rotor speed, while the full order EKF also estimates the stator current components.

It is well known that the EKF algorithm has some drawbacks, like computational effort for real-time applications, complexity and hard tuning of noise covariance matrices. This new approach introduces new improvements and very important and practical aspects that strongly reduce the execution time and simplify the tuning of the covariance matrices.

The reduced order EKF algorithm was implemented and validated in real-time operation using the dSPACE's DS1103 controller board. The experimental results have proved to be very good.

The performance of speed estimation using both EKF techniques is compared with respect to computation effort, tuning of the algorithms, speed range including low speeds, load torque conditions, robustness relatively to motor parameter sensitivity and other important aspects.

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