

I. IDENTIFICATION DATA

Thesis name:	Determination of Induction Motor Speed using Kalman Filter
Author's name:	Ranjan Tiwari
Type of thesis:	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Electrical Power Engineering
Thesis supervisor:	Pavel Karlovsky
Supervisor's department:	Department of Electric Drives and Traction

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	challenging
<i>Evaluation of thesis difficulty of assignment.</i>	
The thesis task is to determine the speed of the induction motor without the speed sensor using the Kalman filter algorithm. It should describe the Kalman Filter theory, design the filter for the motor speed determination and then verify its functionality in simulation and experimentally on real drive.	

Satisfaction of assignment	fulfilled
<i>Assess that handed thesis meets assignment. Present points of assignment that fell short or were extended. Try to assess importance, impact or cause of each shortcoming.</i>	
The Kalman filter and the Extended Kalman filter algorithms are explained and the mathematical description is provided. The mathematical model of the induction motor is described and because of its nonlinearity, the use of the Extended Kalman filter was chosen. The necessary matrixes for the Extended Kalman filter are derived from the motor model. Simulation of the Extended Kalman filter was done in Matlab Simulink and its functionality was verified on a mathematical model of induction motor drive. The experiment on real drive was done using dSPACE ds1103 and the measured results are presented. The work deals with the different cases including steady state, low speed area, speed transients and load change, and with the influence of the coefficient matrixes on the accuracy of the filter. The work shows, where the estimation works correctly and where the error between the estimated and the measured speed is higher. I appreciate that also these cases are presented, and that the possible reasons of the errors are discussed in the conclusion.	

Activity and independence when creating final thesis	A - excellent.
<i>Assess that student had positive approach, time limits were met, conception was regularly consulted and was well prepared for consultations. Assess student's ability to work independently.</i>	
The student was able to work independently in the laboratory and was coming regularly to the meetings.	

Technical level	A - excellent.
<i>Assess level of thesis specialty, use of knowledge gained by study and by expert literature, use of sources and data gained by experience.</i>	
From the literature, he had to learn a lot about induction motor estimate algorithms. During the work on the thesis, he gained experience about behavior of a real drive and its differences to simulation, and also learned about microcontroller implementation issues.	

Formal and language level, scope of thesis	B - very good.
<i>Assess correctness of usage of formal notation. Assess typographical and language arrangement of thesis.</i>	
The formal and language level is good, however, some sentences are hard to understand. The symbols in the equations don't always use correct format.	

Selection of sources, citation correctness

B - very good.

Present your opinion to student's activity when obtaining and using study materials for thesis creation. Characterize selection of sources. Assess that student used all relevant sources. Verify that all used elements are correctly distinguished from own results and thoughts. Assess that citation ethics has not been breached and that all bibliographic citations are complete and in accordance with citation convention and standards.

It is clearly indicated, which part was his work and what was taken from other sources. The sources were selected appropriately. They contain the topics from Kalman filter theory, sensorless control of induction motor and practical implementation issues. However, more sources could be cited.

Additional commentary and evaluation

Present your opinion to achieved primary goals of thesis, e.g. level of theoretical results, level and functionality of technical or software conception, publication performance, experimental dexterity etc.

III. OVERALL EVALUATION, QUESTIONS FOR DEFENSE, CLASSIFICATION SUGGESTION

Summarize thesis aspects that swayed your final evaluation.

I think that assignment level is high since the experimental verification is required. The work fulfilled all required tasks. The Kalman filter was designed, the simulations in Matlab and experiments on real drive were performed and the precision of the Kalman filter at different working points is clearly presented on the measured results.

I have no questions to be answered during the defense.

I evaluate handed thesis with classification grade **A - excellent**.

Date: **6.6.2019**

Signature: