

I. IDENTIFICATION DATA

Thesis name:	Modelling of Synchronous Reluctance Motor
Author's name:	Sakar Emre
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Power Engineering
Thesis reviewer:	Ing. Jan Bauer Ph.D.
Reviewer's department:	Department of Electric Drives and Traction

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	ordinarily challenging
<i>Evaluation of thesis difficulty of assignment.</i>	
The assignment has ordinary difficulty. It supposes author has knowledge about simulations.	

Satisfaction of assignment	unfulfilled
<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 assignment of the thesis has 5 main points. From my point of view points 1, 2 and 5 are fulfilled, however fulfillment of points 3 and 4 is questionable. I don't understand meaning of chapter 4.3 dealing with traction effort curve.	

Method of conception	partially applicable
<i>Assess that student has chosen correct approach or solution methods.</i>	
Chapters dealing with the SynRM theory are OK, but chapter 4 where should be presentation of results and own contribution of the author is very poor and presented graphs are difficult to read and understand.	

Technical level	F - failed.
<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>	
<p>Technical level of the thesis is poor. Thesis is full of inaccurate formulations. For example page 8 – The stator of the SynRM is designed with two different windings... and on page 5 SynRM is a three-phase brushless AC motor. Page 8 For starting the rotor, it is essential that the rotor has aluminum bars... and on page 13 As stated in previous chapters SynRM does not have an excitation winding and also it does not require a rotor cage.... Fig 1.6 mixing control strategies and modulation strategies. Presented example of Sensorless control strategy without current sensors is curious. First of all control without knowing current in electric drives is not very clever because it can't diagnose errors as overcurrent caused by locked rotor or winding shortcircuit. Moreover by my opinion position sensor is more expensive than current sensors. Introducing derivative into control strategy (Fig. 3.3) will be source of control instability. In description of control structure in Fig. 3.6 on page 33 are time loops in seconds instead of mili/micro seconds. I have big problem with model of SynRM, on my opinion it will not work correctly because of current limiters. I can't understand why is sensorless control performed with created model of SynRM and MTPA by model with converter and motor model from Simulink library. Simulation results are unclear. Because the plate of the machine with nominal parameters of simulated SynRM is missing it is hard to evaluate the results or created models. The main complaint against the created model is that I don't understand why there is part presented as model of SynRM, and then there is next part of model where are used prepared blocks from Simulink library. Selection of results is strange. I don't get why is author presenting Fig. 4.22 on page 45, the Y axis of Fig. 4.25 is labeled in (deg) which is obviously wrong. I don't understand meaning of Fig. 4.35 and its connection with simulation works. Moreover it is curious that on Fig. 4.35 is on y-axis is Traction effort in (N) and on Fig. 4.36 is Traction effort in (Nm) and x axis in (RPM).</p>	

Formal and language level, scope of thesis

B - very good.

Assess correctness of usage of formal notation. Assess typographical and language arrangement of thesis.

There are some typos that could be avoided by better reading of the thesis text.

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.

References are well selected and cited according to standards.

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.

Please insert your commentary (voluntary evaluation).

III. OVERALL EVALUATION, QUESTIONS FOR DEFENSE, CLASSIFICATION SUGGESTION

Summarize thesis aspects that swayed your final evaluation. Please present apt questions which student should answer during defense.

On the beginning the first look, the thesis seems to be OK, but when reading the text carefully its full of inaccurate formulations, that seems like author has taken different parts from different references. My main objection is against chapter 4, that should present main contribution of the author own simulation model of SynRM and selected control strategy. There are two strategies that use different models of SynRM and I don't understand why. Presented MTPA control in Fig. 4.4 is very similar to finished model from Mathworks, therefore I am not able to evaluate authors contribution. Moreover I am not able to find in the thesis how is fulfilled 4th point of the assessment (MIL). That is why I evaluate presented thesis as unfulfilled, however I think it is defensible, when author will explain his contribution when working on thesis.

- 1) On page 5 is written that SynRM can be controlled by sensorless control because of high saliency... How is saliency influencing possibility or impossibility of sensorless control?
- 2) Why are we trying to avoid derivatives in simulation models of electric drives?
- 3) Why have you select structure of MTPA as shown in Fig. 3.5?
- 4) Explain meaning of current limiting blocks in Fig. 4.1?
- 5) Explain RPM drops in Fig. 4.13 when the machine is running at no load?
- 6) What is source of current peaks at motor start up in Figs. 4.8 and 4.9, how are they long, why can't be this peaks seen in Figs. 4.28 and 4.29 of MTPA ?
- 7) Explain sentence on page 55: After the nominal speed, the curve is decreasing exponentially as described in previous part. What is influencing the characteristic and what is influencing the decrease?
- 8) Explain why is part dealing with sensorless control without converter and power source and part dealing with MTPA has it included. Can you mention your work(contribution) on both strategies?
- 9) Show how have you fulfilled point 4 of the assignment.



REVIEWER'S OPINION OF FINAL THESIS

10) Show nominal parameters of simulated motor

I evaluate handed thesis with classification grade **F - failed**.

Date: **8.6.2019**

Signature: Ing. Jan Bauer Ph.D.