THESIS REVIEWER'S REPORT

I. IDENTIFICATION DATA

Thesis title:	**Electric Vehicle Battery Pack State of Charge and State of Health Estimation**
Author's name:	**Jan Kučera**
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Control Engineering
Thesis reviewer:	M.Sc. Václav Knap, Ph.D.
Reviewer's department:	Department of Electrotechnology

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	**challenging**

How demanding was the assigned project?

The project tackled a relevant and timely topic of lithium-ion batteries used in electric vehicles. It was based mainly on the implementation of common estimation techniques; however, its scope was fairly large, regarding the inclusion of state-of-charge and state-of-health estimation.

Fulfilment of assignment	**fulfilled with minor objections**

How well does the thesis fulfil the assigned task? Have the primary goals been achieved? Which assigned tasks have been incompletely covered, and which parts of the thesis are overextended? Justify your answer.

The thesis addresses sufficiently and well the first four tasks and goals as stated in the assignment. However, the validation of both algorithms is incomplete and insufficient according to the standard practices. It is acknowledged though that there might be various obstacles to achieving this task in sufficient depth and in time.

Methodology	**correct**

Comment on the correctness of the approach and/or the solution methods.

The introduced methodology of modeling and state estimation is correct. Occasionally, there are missing parts or details of descriptions (e.g., the temperature part of the model). Moreover, a validation of the estimators is required to determine their correctness, ability to converge, and their accuracy. Since a reference was not established or the established simulations do not cover the operation conditions, a proper validation was not achieved.

Technical level	**B - very good.**

Is the thesis technically sound? How well did the student employ expertise in the field of his/her field of study? Does the student explain clearly what he/she has done?

The thesis is technically sound. The applied techniques are well described. However, some descriptions of experiments, simulations, or results are not described all the time very clearly, and could be improved.

Formal and language level, scope of thesis	**B - very good.**

Are formalisms and notations used properly? Is the thesis organized in a logical way? Is the thesis sufficiently extensive? Is the thesis well-presented? Is the language clear and understandable? Is the English satisfactory?

The student followed a standard notation. The thesis was organized to have a logical structure following the workflow. Though, beneficial may be a separate methodology section providing an overall picture and describing clearly adopted approaches and procedures. The coverage of the thesis is very sufficient, and the presentation form is very good. The language is intelligible and appropriate to non-native English speakers of a master's level.

Selection of sources, citation correctness	**A - excellent.**

Does the thesis make adequate reference to earlier work on the topic? Was the selection of sources adequate? Is the student's original work clearly distinguished from earlier work in the field? Do the bibliographic citations meet the standards?

The thesis covers the relevant and important work from the field. Its usage is sufficient and at a good technical level.

Additional commentary and evaluation (optional)
Comment on the overall quality of the thesis, its novelty and its impact on the field, its strengths and weaknesses, the utility of the solution that is presented, the theoretical/formal level, the student's skillfulness, etc.
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III. OVERALL EVALUATION, QUESTIONS FOR THE PRESENTATION AND DEFENSE OF THE THESIS, SUGGESTED GRADE

Summarize your opinion on the thesis and explain your final grading. Pose questions that should be answered during the presentation and defense of the student's work.

The thesis is well written. The selected topic is topical and practical to nowadays needs and trends in the industry. The student based his work on literature, and then applied and adjusted the techniques to his specific topic. The student manifested curiosity and attempted to interpret the observed results. In the thesis, there are present minor mistakes and peculiarities. Especially, an engineering student shall pay large attention to using the correct units. Moreover, it is important to remember that any developed models and estimation algorithms need a proper validation that will convincingly demonstrate their performance. Generally, I found the thesis very good with occasional details to be improved.

The grade that I award for the thesis is **B - very good.**

Questions:

The selected approach for SOH estimation was a joint capacity estimation when SOC and SOH are estimated jointly at the same time step. In what time scales does SOC change? In what time scales does SOH change? Do you think it is suitable to estimate them in the implemented way? What do you think are possible risks of this approach? What could you do to mitigate them?

How exactly this newer SOC estimation would be used and help in Formula Student (to bring more points)? What other functionalities and algorithms do you think could be beneficial to the formula?

Date: **8.6.2022**   Signature: