SUPERVISOR'S OPINION OF FINAL THESIS

I. IDENTIFICATION DATA

Thesis name:	**Hill Climbing Algorithm for Fuel Consumption Optimization of HEV vehicles**
Author's name:	**Kar Anurag**
Type of thesis :	master
Faculty/Institute:	Faculty of Mechanical Engineering (FME)
Department:	Department of Automotive, Combustion Engine and Railway Engineering
Thesis supervisor:	Ing. Josef Morkus, CSc.
Supervisor's department:	Centre of Vehicles for Sustainable Mobility

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	**challenging**

Evaluation of thesis difficulty of assignment.

I consider the assignment to be demanding, the student had to get to know with the IGNITE system of the Ricardo firm, as well as with the optimization software Bee Colony, create new software and apply it to the IGNITE system.

Satisfaction of assignment	**fulfilled**

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.

The assignment is completely fulfilled, the proposed algorithm and the program are functional

Activity and independence when creating final thesis	**B - very good.**

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.

The student worked very independently, but regularly consulted the progress of the work, suggested further action and respected recommendations of supervisors

Technical level	**A - excellent.**

Assess level of thesis specialty, use of knowledge gained by study and by expert literature, use of sources and data gained by experience.

The work is processed at a very good professional level, both in terms of the proposed algorithm and computer program. It is based on data from real vehicles and 4 typical hilly track scenarios. The meta-heuristic environment Bee Colony Optimization is chosen to optimize fuel consumption. The new car model is created. It was necessary to optimize the calculation parameters and behavior of the vehicle at different stages of driving. The next step was to suggest an optimal gear shifting strategy. The results were compared with the original rule-based strategy and the proposed solution showed better results in all cases.
I have only a few formal notes to the work:
- **on Fig. 1, a series-parallel arrangement with a power divider is only one of more possible variants of this arrangements**
- **in the definition of the vehicle (chapter 4.1) is missing an information that it is a full hybrid**
- **contour lines in Fig. 10 are difficult to read**
- **in equations (11) and (14) there are sign errors, in equation (13) Rint is missing at the first member. In program these relationships are correct**
- **on Fig. 25 some branches of decision blocks are not shown**
- **on page 47 lacks a reference to graph 26**
- **SOCmin data in tab. 14 do not correspond to the data in the calculations**

However, these comments do not reduce the overall level of the work.

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Formal and language level, scope of thesis	A - excellent.
Assess correctness of usage of formal notation. Assess typographical and language arrangement of thesis.	
The work is written clearly and comprehensibly, the text is practically error-free. It has a range of 77 pages. Attachments on CD contain a number of processed program functions and detailed results of a large number of calculations. The selected optimal solution is given in the text of the thesis.	

Selection of sources, citation correctness	A - excellent.
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.	
The thesis cites 41 items of literature, to which references are consistently given in the text	

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.
I would like to appreciate the great diligence of the student in creating the algorithm and programs and especially in large number of performed calculations

III. OVERALL EVALUATION, QUESTIONS FOR DEFENSE, CLASSIFICATION SUGGESTION

Summarize thesis aspects that swayed your final evaluation.

Overall, this is a very good work that has fully met its goal.

I evaluate handed thesis with classification grade A - excellent.

Date: **22.1.2021**   Signature: Ing. Joset Morkus, CSc.