SUPERVISOR'S OPINION OF FINAL THESIS

I. IDENTIFICATION DATA

Thesis name:	**Development of a tool for automating the analysis of engine control unit error handling**
Author's name:	**Valentin Pauron**
Type of thesis :	Master
Faculty/Institute:	Faculty of Mechanical Engineering (FME)
Department:	Department of Automotive, Combustion Engine and Railway Engineering
Thesis supervisor:	Prof. Michal Vojtíšek, M.S., Ph.D.
Supervisor's department:	Department of Automotive, Combustion Engine and Railway Engineering

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	Ordinarily Challenging to Challenging

Evaluation of thesis difficulty of assignment.

Engine control units need to reliably cope with a range of errors and failures, including missing of faulty data from various sensors. In this thesis, the student has created a software tool to post-process data from automated tests of engine control units (ECU), where signals from individual sensors were temporarily interrupted, distorted, or replaced, and the responses of the ECUs, pertaining to identification of errors as well as identification of a return to normal state, were recorded. The software was validated by comparing its outputs to results of manual processing of the same data. The assignment was given at the request of the student and was worked on during his internship at Renault in Lardy, France, under local supervision. From software engineering viewpoint, this is an ordinary assignment; for an automotive engineer, with only working knowledge of signal processing, electronic controls and software engineering, the assignment requires some additional learning and can be viewed as challenging.

Satisfaction of assignment	Fulfilled with minor objections

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 software has been developed and apparently is working, judging from the results presented here and from the evaluation and other generally very positive feedback from Renault.
Validation of the software through comparison with results obtained previously by others by manual processing and evaluation of the data is described rather briefly, approximately one page of the text spanning pages 45-46, and in general terms. There is no information about the extent of the validation (how many variables were compared on what number of tests) or its results (the level of agreement between results obtained by manual processing and those obtained by using the software written by the student).

Activity and independence when creating final thesis	Not graded

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.

Mr. Pauron has worked on the thesis under local guidance at Renault and has not consulted the details with me, citing confidential nature of the project, but without providing an explanation that this was the reason. In general, lacking or ineffective communication of the student has resulted in difficulties meeting formal requirements and time deadlines. The communication has greatly improved upon the arrival of Mr. Pauron to the university and his subsequent work on improving his first draft. Mr. Pauron has shown a good degree of knowledge about the subject and has received a very positive feedback from his local supervisors. For these reasons, I am not able to fully assess this aspect of the thesis work.

Technical level   D – Satisfactory

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

The overall technical level of the work done is reasonable. It seems to me that a fairly valuable tool has been developed, and is planned to be used within the Renault group. This by itself is commendable, as well as the rather significant time savings realized by the Renault group from using this software.

However, the work, as presented, is only a modest showcase of engineering knowledge and judgment at master's level. There is no background research – has a similar tool been developed, and if so, is it available, or at least, can we learn anything useful from descriptions of similar work in the literature?

Neither is it clear how reliable and robust the software is. Are there any objective criteria to be benchmarked to? What was the extent and what was the outcome of the validation? Is there a full agreement with the manual processing? If not, what level of agreement is there? And how reliable is the manual processing of the data?

The description is, in many places, not as thorough as desirable for clarity and readability. For example, the entire process of verifying the performance of the software, or software validation, is rather brief. Another example is Fig. 47 on page 47, titled "Example of irregular signals", showing traces of many signals, without any explanation of the meaning of the signals and of the reasons behind irregularity (many seem like the result of conversion of an analog signal into digital), and without showing the time base. In the text following Fig. 39, "dt", apparently the periodicity of a clock signal, is defined as 1 s, while periodicity of about 2-3 s is apparent from the figure itself.

Formal and language level, scope of thesis   D – Satisfactory

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

The thesis is well structured. It is written in good technical English. The writing is, from language point, comprehensible. Abbreviations are explained in the text and listed in a table. The extent of the writing, and the length, 54 pages plus appendices, arranged in a compact and space-efficient format, are appropriate.

Many figures contain text which is too small to be comfortably legible (i.e., Fig. 39). Many figures extend beyond the page margins, so that they would not be legible in a printed and bound version.

It is not apparent anywhere in the thesis that this work is part of the requirements to obtain an engineering diploma at the Czech Technical University in Prague. The thesis bears a title of "Diploma thesis at Renault" and, on each page, a logo of ENSTA, a higher education institution in Bretagne region, France. While the thesis template provided to the students with the university logo and uniform title page is not strictly mandatory, I see the approach taken here as excessively liberal.

Selection of sources, citation correctness   E – Sufficient

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.

A total of 9 sources are cited in the thesis, out of which 5 are labeled as internal documents of Renault, and the rest are general introductory documents posted on the internet. No peer-reviewed literature, such as journal articles, were cited, although published work on the subject is available (peer-reviewed journals, peer-reviewed SAE Technical Papers, …). On page 8, a figure is credited to reference [5], but to this point, only ref. 1 and 2 have been cited; similar situation with ref. [9]. Otherwise, the citations are correct.

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.

Mr. Pauron has initially not consulted the thesis with me due to confidentiality reasons on the side of Renault, where the underlying work has been performed, and handed the first version, falling short of academic standards, at the last minute, not in the prescribed manner, resulting in the first version not being accepted. Instead of taking one more semester to improve the thesis, he then insisted on submitting the revised version within an extended deadline.

From conversations with Mr. Pauron, I have a feeling that he is capable of producing a much better thesis than the final version submitted for defense. This is consistent with my rather moderate grading of the thesis, contrasting with excellent evaluation received from Renault.

I would also like to state that Mr. Pauron's subject was Automotive Engineering, and that the primary task at hand was creating a tool to post-process and evaluate data from ECU tests, and the software he has written is only a tool to accomplish this goal. He has not taken, at CTU, formal software engineering, signal processing, or other classes typically falling under Electrical Engineering rather than Mechanical Engineering department. Therefore, the thesis should be evaluated from automotive engineering, rather than software engineering, point.

III. OVERALL EVALUATION, QUESTIONS FOR DEFENSE, CLASSIFICATION SUGGESTION

Summarize thesis aspects that swayed your final evaluation.

The thesis, assigned on request of the student, revolves around the outcome of Mr. Pauron's semester-long internship at Renault, done primarily under local supervision. While it seems like this was a fruitful learning experience, and Mr. Pauron has received excellent evaluation from the staff at Renault, the thesis is rather modest in terms of academic quality standards, with shortcomings in multiple aspects, as detailed above.

It is my opinion that Mr. Pauron is quite capable of further improving the thesis, but he has opted to insist on submitting the thesis this semester. Therefore, I am evaluating the work as submitted, with a note that the student has, in my opinion, capability and potential to do better.

I evaluate the submitted thesis with classification grade **D -Satisfactory.**

Date: **September 22, 2023**   Signature: