

I. IDENTIFICATION DATA

Thesis name:	Powertrain component topology optimization
Author's name:	Florian Kimmerlin
Type of thesis :	master
Faculty/Institute:	Faculty of Mechanical Engineering (FME)
Department:	Department of Automotive, Combustion Engines and Railway Engineering
Thesis reviewer:	Ing. Vít Doleček, Ph.D.
Reviewer's department:	CTU in Prague – FME, Department of Automotive, Combustion Engines and Railway Engineering

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	ordinarily challenging
<i>Evaluation of thesis difficulty of assignment.</i>	
<p>The thesis is focused on component topology optimization of existing part of the engine. The part is analyzed and the shape is optimized regard to structural design and efficient use of materials. Concurrently with the diploma thesis the presentation with manual how to implement topology optimization in Jaguar Land Rover design team was made. Beforehand, I would like to point out, that diploma work assignment lacks any specific, measurable task definition and is very vague.</p>	

Satisfaction of assignment	fulfilled with major objections
<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>	
<p>The task was to expand topology optimization capability of JLR and optimize one existing component. The research of all available sources, which could result in list of all possible solutions in topology optimization field. This part is practically missing in diploma thesis and diploma thesis introduction is too brief.</p> <p>The work itself describes workflow of topology optimization, which is done in several steps. Choice of such process is not clear and substantiated. After optimization of shape, the part is remodeled in 3D CAD and the FEM analysis is made again. It should be proceeded in one step, taking into account all necessary constraints. Only this solution can guarantee fulfilling all required qualities of optimized solution. Consideration of load cases required for analysis was obviously not made and final result of optimization suffers by it (unconnected design and non-design spaces). Iteration procedure of manual optimization can be made by taking off unloaded material can be better solution in this case considering very complex topological constrains.</p>	

Method of conception	partially applicable
<i>Assess that student has chosen correct approach or solution methods.</i>	
<p>The brief research of topology optimization does not result in one suitable procedure for given engine component. It is not clear why the whole optimization is proposed as a multi step procedure. The whole part has to be remodeled to look similar to topology optimized result. All demands, loads and constraints should be prescribed for optimization together with technology claims of production method (e.g. minimal wall thickness and wall skewness). If not, the part can be only 3D printed or remodeled, which is not necessary. The diploma thesis does not describe why 30% of initial volume was set as a target value for optimization. Adoption of proposed design is not possible due to the fact it was not analyzed although it was proposed as the step 2.</p>	

Technical level	D - satisfactory.
<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 topology optimization is dependent also on FEM analysis. It is not clear how the simulation model is loaded, where it is loaded, where the constraints are and how the part temperature is applied. From the resulted component shape is obvious, that some material is completely taken out. Likely, some important constraints are missing. The result of optimization procedure is missing some functional parts and there is only statement that it will be used</p>	

together with plastic cover. The result presented in a figure 42 and 43 does not look, that its function can be same as original part in figure 11 and 12.

Formal and language level, scope of thesis

D - satisfactory.

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

Typographical arrangement of the work is on a poor level. The paragraph titles are not numbered according to demands claimed on diploma thesis. The work contained only 30 pages and it is very brief for diploma thesis. The student and the company probably have not been acknowledged about formal requirements of typical diploma thesis.

Selection of sources, citation correctness

D - satisfactory.

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.

Literature research and bibliography of used sources is basically non-existing in this diploma thesis. Student did not use any sources to create introduction in to the very interesting field of shape and topology optimization. It should also be emphasized that software used provides very good manual including tutorial for beginners and own free theory book.

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.

Overall level of the thesis seems to be a description of internship, not diploma work. Even a description of software tools and their testing would give more valuable knowledge. We should keep in mind that shape optimization is also advanced tool requiring knowledge of the FEM theory and principles. It is not evident that this condition is fulfilled in this case, thus limiting student to meaningfully use the tool, getting any valuable result and comprehensive discussion of it.

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.

I evaluate handed thesis with classification grade **E - sufficient**.

Date: **4.9.2018**

Signature: