ČVUT
ČESKÉ VYSOKÉ UČENÍ TECHNICKÉ V PRAZE

REVIEWER'S OPINION OF FINAL THESIS

I. IDENTIFICATION DATA

Thesis name:	**Optimization of a Birotary Engine by means of a Simulation Model**
Author's name:	**Bc. Daniel Piskač**
Type of thesis :	master
Faculty/Institute:	Faculty of Mechanical Engineering (FME)
Department:	Department of Automotive, Combustion Engine and Railway Engineering
Thesis reviewer:	Ing. Václav Rychtář Ph.D.
Reviewer's department:	Škoda Auto a.s.

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment — **challenging**

Evaluation of thesis difficulty of assignment.

The difficulty of evaluated work lies in the engine design, which is a little used. There are only a few relevant sources to set up the GT model and that complicates optimization itself. Author could not set an usually used coefficients and the GT model composition.
Moreover minimum of the usable and reliable measurement results make the model confirmation difficult.

Satisfaction of assignment — **fulfilled with major 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 main shortcomings of the reviewed thesis are following:
- Incomplete description of the base GT model. It is very complicated to recalculate and check model results or find incorrect settings. Many parameters used in the model are not mentioned.
- Measurement results are not suitable for confirmation. These are incomplete and seem to be unreliable.
- Improper choice of the engine characteristic according to its purpose. I expect author should optimize the engine characteristic for an airplane propeller. The propeller demands a different engine characteristic than the automotive engine needs but author does not respect it.

Method of conception — **outstanding**

Assess that student has chosen correct approach or solution methods.

Chosen methods correspond with target and are suitable to reach good results. CFD could be used as a helpful tool to understand solved questions.

Technical level — **C - good.**

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

Author follows up previous projects of other students and uses results and experiences of the engine producer. His work lies in GT model optimization with focusing on real engine approach, engine characteristic and blow-by. I would expect student to use more of the knowledge dealing with combustion, friction, blow-by, sealing etc. especially if the thesis is focused on it.
The formula (5) on page 46 is given with mistake. This formula is valid for engine speed unit in minute but the list of abbreviation states engine speed unit in seconds.
Stated charts often have incomplete axis labels. Mainly the axis Y often uses general designation *pressure* but it can represent many different values.

Formal and language level, scope of thesis — **A - excellent.**

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

Formal and language level is high and reviewed thesis meets all standard requirements.

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Selection of sources, citation correctness	**C - 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.	
I did not find any contradictions with citation conventions. Each source and citation are separated relatively well. The student's own work and results can be easily recognized. I missed the use of standard and proven sources as books, SAE papers, conference collections, patents etc.	

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.
In the first part author dealt with rotary engines history. He brought the large overview of many different designs and principles ever used. This part is very interesting. In the second main part student introduced results of the GT model optimization with focusing on the compression ratio, blow by, exhaust and intake manifold. The computation was based on the old GT model composed by other student. Author used measurement results of the real engine as a confirmation but these were fatally influenced by wrong operation of the engine that ended up in engine crash. Because of that the GT model reliability is low, which can be considered as the first drawback of the presented thesis. The second one is disrespecting purpose of the engine. The engine is designed for an airplane propulsion and propeller interaction but the reviewed thesis does not take account of this fact and author solved problem similar to automotive engine.

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.

Positive side of the presented work is high formal and language level and really extensive overview of the rotary engines. Author also solved the difficult unexplored topic without a common source availability.

Negative side of the thesis is disrespecting the airplane propeller characteristic. Usage of the unreliable and incomplete measurement results for optimization makes the stated model and results less useful.

Defense question:

A classic four-stroke rotary airplane engine must have an odd number of cylinders for its operation to be regular because one full cycle takes two crankshaft revolutions. The presented birotary engine takes the whole cycle in half a turn. In this case, what is the reason for the odd number of cylinders? The three-cylinder design leads to a very disadvantageous bore / stroke ratio.

I evaluate handed thesis with classification grade **C - good.**

Date: **26.1.2021** Signature: