# REVIEWER'S OPINION OF FINAL THESIS

## I. IDENTIFICATION DATA

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| **Thesis name:** | **Gasoline Engine Emissions and TWC Modeling in Axisuite** |
| **Author's name:** | **Shankar Balaji Shanmughanathan** |
| **Type of thesis :** | master |
| **Faculty/Institute:** | Faculty of Mechanical Engineering (FME) |
| **Department:** | 12120 |
| **Thesis reviewer:** | Ondřej Bolehovský |
| **Reviewer's department:** | 12120 |

## II. EVALUATION OF INDIVIDUAL CRITERIA

**Assignment** **challenging**

*Evaluation of thesis difficulty of assignment.*

The topic of the thesis is quite specific and requires the student to learn the theory of catalytic converters and get familiar with specific simulation software.

**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 was fulfilled, all points were included in the work.

**Method of conception** **correct**

*Assess that student has chosen correct approach or solution methods.*

The aim of the work was to develop a simple and fast method that would help to predict deterioration of performance of three way catalytic converters after certain periods of time or number of kilometers. The student observed the behavior of the conversion efficiency of three differently aged TWC converters and had to derive a function that correlates with the experimental data. By means of averaging he reduced the number of required inputs for the simulation model. The subsequent validation confirms satisfying correlation of results, therefore the method was correct. However, the main student's contribution or investigation – the ageing law – is not presented in the thesis, not even in the parametric form due to confidentiality reasons.

**Technical level** **B - very good.**

*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 contains extensive introduction to three way catalytic converters and their ageing issues. The student had to carry out exploration of various sources and summarized these knowledge in a well arranged way in the work. The technical level is very good, I appreciate the observation and analysis of simulation results and explanation and reasoning of inaccuracies on presented figures. Mathematical description and deeper analysis of the ageing law would, however, even increase the technical level.

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

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

The work is well and logically arranged. Language is good, however, student's message is sometimes not completely clear. Typing errors or inaccuracies occur in places (e. g. page 26: "..to reduce NO when slight excess of oxygen…"). Student presents technical issues in charts well, however, the charts are sometimes small (including x axis) and of low quality. It is also my duty to mention that the official name of the university is with the supplement "in Prague" (in the page header).

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ČESKÉ VYSOKÉ UČENÍ TECHNICKÉ V PRAZE

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| **Selection of sources, citation correctness** **C - good.** |
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| *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.* |
| Sources used and stated by students are relevant and broad, however, the citation is missing at some figures, which makes it hard to recognize author's own work/figures. Some information gained from older literature should also be examined and confronted with actual state of the art (particulates from leaded gasoline). |

| **Additional commentary and evaluation** |
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| *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.* |
| Please insert your commentary (voluntary evaluation). |

**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.*

Shankar by his thesis proved that he is able to handle an engineering task. He composed quite large introduction to TWC theory and their ageing issues based on a number of relevant sources. Then, by analyzing results of experiment, he defined the ageing law, the correctness of which he consequently validated on a different TWC type. Unfortunately, the ageing law essence is not presented in the work (not even in a non-disclosure form), which decreases the technical level of the work.

The work is logically and comprehensibly arranged, however, some mistyping or careless errors occur. I appreciate the analysis of the results by going deeper into the chemical background of the model and determining the source of inaccuracies. Regarding the formal level, I was missing references to used figures and I would recommend larger or higher quality figures, particularly charts.

**Question:** What is the form (at least in a parametric form) of the ageing law and how was it derived?

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

Date: **9.2.2018** Signature: