

## I. IDENTIFICATION DATA

<b>Thesis title:</b>	<b>Investigation on influence of oil on composite materials</b>
<b>Author's name:</b>	<b>Jaykishan Patel</b>
<b>Type of thesis :</b>	master
<b>Faculty/Institute:</b>	Faculty of Mechanical Engineering (FME)
<b>Department:</b>	Department of automotive, Combustion Engine and Railway Engineering
<b>Thesis reviewer:</b>	Ing. Tereza Zámečnicková
<b>Reviewer's department:</b>	Department of Mechanics, Biomechanics and Mechatronics

## II. EVALUATION OF INDIVIDUAL CRITERIA

<b>Assignment</b>	<b>ordinarily challenging</b>
<i>How demanding was the assigned project?</i>	
The complexity of the project corresponds to the diploma thesis. The student validates FEM models and computational models compiled in the Matlab environment with experimentally obtained data.	

<b>Fulfilment of assignment</b>	<b>fulfilled</b>
<i>How well does the thesis fulfil the assigned task? Have the primary goals been achieved? Which assigned tasks have been incompletely covered, and which parts of the thesis are overextended? Justify your answer.</i>	
The assignment was fulfilled in all points. The student participated in the preparation of the experiment of liquid diffusion into composite specimens and subsequent tensile tests of specimens exposed to liquid and pure specimens. He created a script in Diadem-IN to evaluate the experimental data. He also used the Matlab environment for data processing, in which he also performed theoretical calculations. Other goals of the work were to create FEM models for liquid diffusion into a composite material and a tensile test model of a composite specimen exposed to liquid diffusion.	

<b>Methodology</b>	<b>correct</b>
<i>Comment on the correctness of the approach and/or the solution methods.</i>	
The topic of the work concerned the validation of a model of fluid diffusion into a composite material. The student compared theoretical computational models of fluid diffusion with experimental data. First, it determined the course of diffusion in the heated operating fluid (oil) by measuring the weight of the specimens exposed to this fluid. He also performed mechanical tensile tests of samples exposed to the operating fluid and pure samples. Another procedure was to create FEM models of fluid diffusion into the composite sample and its tensile loading. This procedure is completely in line with the usual procedure in technical practice.	

<b>Technical level</b>	<b>C - good.</b>
<i>Is the thesis technically sound? How well did the student employ expertise in the field of his/her field of study? Does the student explain clearly what he/she has done?</i>	
During the regular study, the student got acquainted with the work in the Matlab and Abaqus programs. He used this knowledge in his diploma thesis. In these programs, he compiled models, which he validated with the experiment. During this process, which is described in the thesis, the student got acquainted with the theory needed to model the diffusion of liquids in FEM software and the basics of the theory of modelling composite materials. In the part concerning FEM, the student considers the creation of a model to meet the requirement of getting as close as possible to reality, as well as the possibilities of computer technology and saving the time needed for one calculation. The student used professional scientific articles and other professional literature to find information that is not part of common study subjects.	

**Formal and language level, scope of thesis**

**D - satisfactory.**

*Are formalisms and notations used properly? Is the thesis organized in a logical way? Is the thesis sufficiently extensive? Is the thesis well-presented? Is the language clear and understandable? Is the English satisfactory?*

The work is written in English and is printed unilaterally. The student uses an active and passive language. The work is structured into numbered chapters in four levels, while the content contains only paragraphs numbered to the third level. Figures and equations are numbered according to common practices. Although the work is usually divided into thematic paragraphs, there are a few inconsistencies.

In Fig. 2, symbols are used without further explanation in the label. On page 20, the symbol  $T_g$  is also used without further explanation. It is completely unconventional to express some mathematical relations using the names of the quantities used instead of using symbols with a subsequent explanation of the meaning. According to the opponent, this concept creates mathematical relations in confusing. For mathematical relations given traditionally, the explanation of the symbols is given unsystematically or is missing at the first occurrence of the symbol. The symbol  $S$  is used for both solubility and surface. In the text, the diameter symbol ( $\varnothing$ ) is probably confused with the letter theta -  $\theta$  (eq. 16). Tables 2, 3, 5 do not show the units in which the values are expressed. These details make the thesis more difficult to read.

**Selection of sources, citation correctness**

**D - satisfactory.**

*Does the thesis make adequate reference to earlier work on the topic? Was the selection of sources adequate? Is the student's original work clearly distinguished from earlier work in the field? Do the bibliographic citations meet the standards?*

The student uses mainly specialized scientific articles and research reports, literature and manuals of used programs available from the Internet. The taken sections are visibly marked in the text.

The student does not use a common standard for citing taken sources (ČSN ISO 690: 2011) or any other established standard (Oxford style, Harvard, MLA).

There are gross shortcomings in the bibliography. Item [3] is not traceable and obviously lacks a document title. Only the initials of the first author are listed in item [4]. Item [29] is a copy of item [24]. The student does not state ISBN or ISSN of cited items.

**Additional commentary and evaluation (optional)**

*Comment on the overall quality of the thesis, its novelty and its impact on the field, its strengths and weaknesses, the utility of the solution that is presented, the theoretical/formal level, the student's skillfulness, etc.*

The results of the work generally meet the requirements in all points. The student used professional software for data processing (Diadem - IN, Matlab, Abaqus). He built the results on the basis of theories published in the literature.

Unfortunately, the elaboration of the diploma thesis is not entirely appropriate. There are several inaccuracies in the text (It's mentioned above). The mathematical nature of the models is not clearly stated. Examples of experimental data processing are not given. There are also no examples of how the data was processed into the final graphic form. The overall data processing is not entirely clear, leading to doubts about the repeatability of the comparison of FE models and computational models and the experiment. In the case of FE models, it would be appropriate to a state where the numerical values were taken from (eg indicate the position of the examined nodes/elements).

### III. OVERALL EVALUATION, QUESTIONS FOR THE PRESENTATION AND DEFENSE OF THE THESIS, SUGGESTED GRADE

*Summarize your opinion on the thesis and explain your final grading. Pose questions that should be answered during the presentation and defense of the student's work.*

The student demonstrated a comprehensive concept of an experiment with validation using a computational and FE model. I outlined the shortcomings of the work in the previous points of the evaluation. I evaluate the work as satisfactory in terms of elaboration of the topic and presentation of the final results. I have the following questions for the thesis.

*First question:*

The direction of the 3D print nozzle guide and the orientation of the part in the print space can affect the material properties of the final product. In what position were the specimens printed? What was the trajectory of the 3D printing nozzle? How was the orientation of the fibres in the specimen ensured?

*Second question:*

How did the optimization process and curve-fitting contribute to the resulting curves? For which part of Fick's model was the optimization applied? Which value was minimized by function 'fmincon'?

The grade that I award for the thesis is **D - satisfactory**.

Date: **2.9.2021**

Signature: