

**I. IDENTIFICATION DATA**

<b>Title:</b>	<b>Model of polymer melt flow in extruder screw</b>
<b>Author:</b>	<b>Udit Negi</b>
<b>Type of thesis:</b>	master thesis (diploma thesis)
<b>Faculty/Department:</b>	Faculty of Mechanical Engineering (FME)
<b>Department:</b>	Department of Process Engineering
<b>Reviewer:</b>	Ing. Jiří Moravec, Ph.D.
<b>Reviewer's affiliation:</b>	CTU in Prague, Faculty of Mechanical Engineering, Dept. of Process Engineering

**II. CRITERIA EVALUATION**

<b>Assignment</b>	<b>average demanding</b>
<i>Evaluation of the difficulty level of the assignment.</i> The task for the student was to perform a literature search concerning extrusion process, devices and fluid flow phenomena in an extrusion screw. Upon the search, the author should create a model of a melt flow in a screw channel with given geometric parameters of the screw, physical parameters of the melt and operation conditions of the process (constant screw revolutions, without heat transfer). The main aim was to investigate a velocity field in the screw channel and perform approximate comparison of pressure loss in the channel with analytically calculated values or with values found in literature. The tasks in the assignment are similar to the tasks, which were required and solved by student during his studies. The difficulty level of the thesis is thus average. The assignment is adequate for a master thesis.	<b>average demanding</b>
<b>Solution procedure</b> <i>Assess whether a correct procedure or method has been chosen by the student.</i> The author followed the steps given by the assignment, which led him to use a correct procedure of work.	<b>correct</b>
<b>Assignment fulfilment</b> <i>Evaluate whether the submitted work fulfils the assignment. Specify eventually in comments which points were not fully met or vice versa whether the work is extended in some parts in comparison with assignment. If the assignment was not fulfilled completely, try to assess severity, impacts and eventually causes of particular shortcomings.</i> The submitted thesis fulfils the assignment. All tasks were solved in the work, but I have great reservations to the quality of the work. Almost the whole first part, literature search, was created by direct copying and pasting of the whole texts from references and referred using direct quotes. This is probably legal, but absolutely unprofessional. The quality of other two practical parts is also very poor.	<b>fulfilled with greater reservations</b>
<b>Professional level</b> <i>Evaluate the level of expertise of the thesis, how the student uses knowledge achieved by study or obtained from scientific literature or practice.</i> For the successful fulfilment of the practical tasks of the assignment, the author had to apply fundamental knowledge of polymer processing, transfer phenomena, rheology and CFD. Unfortunately, I have to say, that the quality level of the analytical and even the CFD solution of the melt flow in the screw channel is bad. Even though similar analytical calculation is standardly done during studies (fundamentals of polymer processing), the student applied much more simplified way of calculation to solve the problem neglecting the effects of side walls and curvature of the channel. Unfortunately, his solution contains mistakes. The quality of the numerical solution is also questionable. There were presented no information about quality of meshing, courses of residues during iterations, etc. The calculated results were just printed in tables without any comments or discussions. The final conclusion is written in general way and therefore meaningless. The professional level of the whole work is thus very poor. The given grade E is a benevolent assessment.	<b>E - sufficient</b>

**Bibliography, citation correctness**
**E - sufficient**

*Comment the student's activity during the acquisition and use of learning materials to solve the thesis. Characterize the selection of bibliography. Assess whether the student used all relevant sources. Verify that all obtained information is properly distinguished from student's own results and considerations, whether citing is done correctly corresponding to the ethical rules, whether bibliographic citations are complete and whether all citations are in accordance with the practice and standards.*

As it was mentioned above, the whole literature search was referred using direct quotes. Fortunately the citing is done in a legal way in most cases at least. In some cases, text is not used complete, as it is written in the original paper, but some parts of text or words are omitted or added vice versa. This is, however not visible in the citations (the whole text in each subchapter is written in one quotes. The copied texts contain mistakes in some parts of the thesis. It might me caused by retyping errors. The format of references in the list of reference is quite correct.

**Formal and language level, work extent**
**E - sufficient**

*Assess formal correctness, typographical and linguistic aspects of the thesis.*

The work has 58 pages, but the amount of pages does not correspond to the content extent, which seems to be much lower. It is probably caused by the problem of copying the whole texts in part of literature search, but also by inappropriate and disordered formatting. Typographical level of the work is low. Figures and tables are not properly described in the text. Numbering of equations is incorrect. The formatting of equations is bad. Author does not use subscripts. Pages are numbered, but the numbers are placed at the inner margin, which is not a good choice, as it is not visible good. Typographically, the work has low level.

The work is written in English. From grammatical point of view, the work contains quite a lot of mistakes and misspellings, including copied texts, which were probably retyped, as there are also mistakes or missing text. I indicated some of the mistakes directly in the thesis.

**Other comments**

*Comment the reached level of the main results in the thesis, e.g. the level of theoretical results or the level and functionality of presented technical solution, publication outputs, experimental skills, etc.*

In the summary, I have to say that I have doubts about the author's knowledge and skills. The submitted work has very poor quality. Below I write detail comments to the submitted work.

**III. FINAL EVALUATION, QUESTIONS FOR THE DEFENCE, CLASSIFICATION DEGREE PROPOSAL**

*Summarize aspects of the final work, which influenced your final evaluation at most. Write out questions, which should be answered by the student at the thesis defence.*

**Detail comments to the work (not mentioned in the previous parts):**

- P. 0 (Title page): "Department of Process Engineering".
- P. 1: "Czech Technical University in Prague".
- P. 4: Wrong formatting of Table of Content (doubled chapters, empty spaces, missing numbering, etc.).
- P. 11: Missing parts or added text – differences from original paper.
- P. 15, 1. R: Why there is source [12] – it is not in order at this point.
- P. 16-19: Changes in text in the direct quote – differences from original paper.
- P. 19, "TWIN SCREW EXTRUDER" – "Clextral" is a company.
- P. 22, ch. 2.3, row 2: There are two authors of this work, but just one is mentioned.
- P. 22-28: Changes were made in quoted text (changed numbers of figures, omitted text).
- P. 24: A lot of free space in the page.
- P. 29-36: The last paragraph is a part of reference [9]. Changes were made in quoted text.
- P. 41, Fig. 20, 21: Where is it referred in text? Why is it placed directly at this page, if possible describing text is on further pages? Caption could be improved.
- P. 43, Fig. 22: It is unclear whether it is a text or a figure caption.

- P. 44:  $W = (t-s) \sin \alpha$ . Velocity  $U$  represents angular velocity, but the velocity in the direction of the channel should be determined to use it in the further equations – eq. (10). Caption of Fig. 24 could be improved. It would be better to use subscripts in equations.
- P. 45: There exists a better way of calculation using characteristics of a screw pump and a die. It enables to calculate with effects of channel side walls and curvature of the channel. There is “ $u$ ” instead of “ $\mu$ ” in the eq. (13). What is in the table 5? What is the meaning of parameter  $b/a$  in the table 5?
- P. 46: There should be “ $u$ ” instead of “ $\mu$ ” in the numerator of the eq. (15). Corrections must be done also in eq. (16). Missing reference in chapter 3.4, row 2.
- P. 47: The values in Tab. 5 cannot be checked due to missing values substituted in equations, but I think the resulting values are not correct (taking into account the mistakes in previous equations).
- P. 48: Each figure in the chapter should be referred and described in text. The same holds for Fig. 26, 27).
- P. 50, chapter 4.3: Density is set to  $1000 \text{ kg/m}^3$ . Does it mean that you calculated with water? Why is the velocity of the fluid equal to  $0.1 \text{ m/s}$ ?
- P. 51: Definition of  $D_H$  was already given by the equation 19. Figure 29 is not referred anywhere in the text. Description of the process of calculation is weak.
- P. 53: It is not described, how did you get the numbers of iterations.
- P. 54: Some comments or discussion to the results would be helpful.
- P. 56: How were determined the values of flowrates in the table 6 (column CFD)? Comments and discussion should be added.
- P. 57: The conclusion is more summary than conclusion.
- P. 58: Dates of citation of literature should be probably 1. 6. 2018 instead of 1. 9. 2018, I guess.

**Questions for the defence:**

- 1) What is the meaning of  $\Delta p$  in the figure 20? What parameters were given and what parameters were calculated in the analytical solution?
- 2) Did you check the quality of the meshing grid? What was the result? How the course of residues looked like? Why there were used 3000 and subsequently 2000 iterations?

If I summarize all the above mentioned comments and evaluation notes, I have to write that the thesis has very poor quality. It is a question whether is the author able to work independently as a mechanical engineer. However, I hope he improves my bad feeling about the work at the defence. I suggest the thesis for the defence with the classification grade

**E - sufficient.**

Date: 1. 9. 2018

Signature:

Ing. Jiří Moravec, Ph.D.

v. r.