

Thesis review- supervisor

Thesis title : 3D Printing of Electrical Machines

Student: Bc. Mohamad Ghaith Almasri

Study program: Automation and Instrumentation Engineering

The goal of the thesis was to examine the possibilities of 3D printing of electrical machines (focusing on transformers), to prepare a printer that would be suitable and to experimentally test the results.

The student was very active in working on the thesis. In the review part he was going to very fine details of what is required and where to obtain it (for example the paste materials). He was also very active in working on the topic in the labs and at home. We have had regular meetings. I highly appreciate the student's activity on the thesis. He also took part in the faculty student's competition (STČ 2023) and won the first price in his session. I highly appreciate his work.

Unfortunately, the student has miscalculated the time required to prepare the thesis and to write it properly. He has the results, he has obtained them in the lab, but he did not have time to describe them at all in the text of the thesis. He also confused the date required to submit the thesis, despite me alerting him about 10 days in advance that the deadline is approaching fast. He knew about the deadlines for submission for several months. I have told him on many occasions what and when he has to do something and when it needs to be submitted. Without much success. Therefore the outcome is tragic. The review part of the thesis is quite detailed, an ok, but the thesis as a whole looks like the student has done only a review. This is not true, he has spent lot of time working on the design, in the lab, on the experiments. Unfortunately the reader of the thesis will see none of this. The experiments are not described at all, there is not a single calculation in the thesis (for example the force or torque required for paste extraction), the results are not explained at all, it is not clear how the experiments were made and why.

If I would evaluate the thesis as a reviewer I would certainly evaluate it with F – failed. The presented text of the thesis is bad. Not the review part (that is fine, more detailed that would be necessary) but the experimental and result part. As the supervisor, I have seen the activity of the student on the thesis and this was excellent. He has the results, but due to his bad time planning he did not have time to write about what he has done. In my opinion the thesis should be reworked and resubmitted. This concerns chapters 4 and 5, now containing only figures without any explanation at all. Also info about the printed transformers he has made must be included.

In my opinion the student is quite able to perform engineering work, however he needs to significantly improve his time planning and not to focus on so many details in a review. Instead he should focus on his own results and how to present them.

In my opinion the thesis should be reworked and resubmitted. However considering the student's really good activity on the thesis I evaluate the presented thesis with "E- sufficient".

Specific problems of the thesis:

- The pdf version of the thesis is missing abstract and keywords. Both in English and in Czech. Both is at least present in KOS.
- The review part goes in quite details, for example it is not necessary to explain the principles of an electric motor, generator or transformer. This is unnecessary and only further extends the length of the document. On the other hand it provides a good insight in the materials and technologies considered. It also shows that the student is capable of delivering good results when he has enough time. I would prefer a much shorter review part, as I have told the student it should have been about ½ of what it is.
- Section 1.7.3.3. Applications and Opportunities mentions many example applications, but lacks any reference to them.
- Reference for fig. 22 is missing. Is it some other author?
- In chapter 2.3 I am missing at least some calculation for the force required to push out the paste. Or some experiment to measure it. From the force it is then possible to calculate the required torque for the extruder motor. Was a geared motor considered? For example with a worm or planetary gear? This would increase the available torque.
- In chapter 2.4 the text *"...modifications to the "syringe holder" (see Fig. 3.1, part (2))..."* references to a non-existing figure. There is also written *"Subsequently, it allows gaining control of the amount of hydrogel deposited, following the principle:"*. What is meant by hydrogel ?
- Chapter 2.4.1 mentions design files. However there is no appendix to the thesis (not submitted), so the design can't be further developed. Location of files is given as "Author (Index)". What does this mean?
- I like the detailed build instructions in section 2.4.4.
- Chapter 3.1. Again presents a quite detailed review of conductive and insulating pastes. Here the student writes *"Paste viscosity we are looking for 80 to 110 [Pa. s]."*. Based on what is this decision made?
- Chapter 3.1.2 mentions *"The details of material preparation will be discussed in the following chapter."*. However there is no such chapter.
- Chapter 3.2 is quite long, the code snippets make the chapter long, and it would be more efficient to just describe the used settings.

- Chapter 4 is “Experimental Work”. There is only a single figure in the chapter, not a single line of text, the experiments made are not described at all. There is not a single schematic, how the experiments was made, no description, not even a block diagram. Nothing that would explain what experiments were made and how.
- Chapter 5 “Results and Discussion”. There are charts, but they are not described, not explained how they were obtained, what is their significance etc. Figures in this chapter are not labeled, same in chapter 4. I understand the charts only because I know what the student was testing and I was present to some of the experiments. If I would only read the thesis text, I would not understand the results at all.
- **Chapter 4 and 5 should be completely reworked.** The results are fine, but they need to be explained. Both their significance and how they were obtained as well.
- Also the thesis lacks any mention on the prototype transformer the student has prepared.
- The list of appendices is present but empty. Why is it then there?

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