THESIS REVIEWER'S REPORT

I. IDENTIFICATION DATA

Thesis title:	**Heat transfer of electronic device cooling**
Author's name:	**Giang Truong Nguyen**
Type of thesis :	bachelor
Faculty/Institute:	Faculty of Mechanical Engineering (FME)
Department:	Department of Process Engineering
Thesis reviewer:	Ing. Jaromír Štancl, Ph.D.
Reviewer's department:	CTU in Prague, FME, Department of Process Engineering

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	**ordinarily challenging**

How demanding was the assigned project?

The Thesis assignment focuses on cooling of electronic device by air, or water-cooled heat sink using modeling of heat transfer processes. From my point of view the Thesis assignment is ordinarily challenging.

Fulfilment of assignment	**fulfilled**

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.

All tasks given by the Thesis assignment have been fulfilled. On the other way, some tasks (literature review and analysis of influence of thermal paste) are discussed only shortly and very superficially.

Methodology	**correct**

Comment on the correctness of the approach and/or the solution methods.

Student used CFD simulation of conductive heat transfer steady state process to find the most important parameters influencing the CPU cooling and select the combination of parameters which meets given conditions. Selected methodology is correct.

Technical level	**D - satisfactory.**

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?

Technical level of the thesis is good, but sometimes especially the parameters for CFD model are only mentioned without any discussion. Student declared his ability to solve independently given technical problem and use the knowledge gained from the study. On the other hand, certain theoretical reserves are noticeable.

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

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?

Formal and language level of the Thesis is excellent. The Thesis is well and logically organized.

Selection of sources, citation correctness	**E - sufficient.**

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 selection of the sources is mainly on popular posts from internet, the scientifical articles are represented in minority. In my opinion, the student should have paid more attention to scientific sources (articles). All information from external sources are properly cited. Bibliography style is quite strange.

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 Thesis assignment focuses on cooling of electronic device by air, or water-cooled heat sink using modeling of heat transfer processes. Student used CFD simulation of conductive steady state heat transfer process to find the most important parameters influencing the CPU cooling and select the combination of parameters which meets given conditions for CPU temperature and its ability to be cooled down by water/air cooling device. I see the used methodology as correct.

The quality of literature review is poor. The literature review is processed only for the purpose of fulfilling the assignment and very superficially. Firstly, the author focuses on basics of conductive and convective heat transfer phenomena. But according to the Thesis assignment the author should focus more on heat transfer phenomena of composite walls. Similarly, the problematic of thermal resistance is discussed only superficially (only what is thermal resistance). Here I would expect more attention to the issue of thermal resistances – how can be expressed, reduced, how great can be their impact on conduction etc. using scientific articles to this topic. Analysis of the influence of thermal paste layers on the heat transfer between solid walls is discussed only briefly. The selection of the sources is mainly on popular posts from internet, the scientifical articles are represented in minority. All information from external sources are properly cited. Bibliography style is quite strange (combination of different citation styles).

In the main part about CFD solution in Ansys Fluent seems to be more tutorial to the Ansys Fluent, the assessed parameters for the model and solution process should be more discussed (for example the reason using k-epsilon model and, constant settings etc.).

Formal and language level of the Thesis is excellent. The Thesis is well and logically organized.

Student declared his ability to solve independently given technical problem and use the knowledge gained from the study. On the other hand, certain theoretical reserves are noticeable.

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

Questions:
1) **In the chapter 2.3 you mentioned different mixtures of bonding and filler materials for thermal pastes. Is it possible to tell which combination of bond and filler will have the best performance (for example silicones or acrylates-based pastes with silver filler will be better/worse selection than… because…)?**
2) **Chapter 3.2 – figure 11. I can see 3 thermal paste layers. Why the "box" is used in your design? Is it possible to connect the CPU directly to the cooling channel by its mounting plate which minimize the amount of thermal paste layers and amount of contacts?**
3) **Can you discuss what exactly expresses the equations 6 – 10 in the chapter 4.1? Please indicate the conditions for validity of equation 6. Is this equation suitable for your problem?**
4) **How is thermal paste applied? Is there any special equipment for this purpose to keep 100 microns paste layer thickness?**
5) Chapter 6 – In your design you assume single water channel. Can you discuss (without any solutions) if there will be some effect if the channel will be split into two or three parallel channels?

Date: **4.2.2023**   Signature: Ing. Jaromír Štancl, Ph.D.