

## I. IDENTIFICATION DATA

<b>Thesis title:</b>	Light propagation in algae photobioreactors (Šíření světelného záření v řasových fotobioreaktorech)
<b>Author's name:</b>	Rehmat Ullah Usman Ullah
<b>Type of thesis:</b>	bachelor
<b>Faculty/Institute:</b>	Faculty of Mechanical Engineering (FME)
<b>Department:</b>	Department of Process Engineering
<b>Thesis reviewer:</b>	Ing. Štěpán Papáček, Ph.D.
<b>Reviewer's department:</b>	Jihočeská univerzita v Č. Budějovicích, FROV, Ústav komplexních systémů

## II. EVALUATION OF INDIVIDUAL CRITERIA

<b>Assignment</b>	<b>challenging</b>
<i>How demanding was the assigned project?</i>	
This work takes its motivation from one previous work on the similar topic related to CFD analysis of macroalgae movement in cylindrical tanks (Ing. Filip R., 2019) and explores the possibility to perform (simultaneously) a simulation of light transfer into the algae suspension.	

<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>	
This work follows all 4 prepared guidelines.	

<b>Methodology</b>	<b>correct</b>
<i>Comment on the correctness of the approach and/or the solution methods.</i>	
The CFD simulations of light transfer within a flat panel photobioreactor were performed using 3 models available in ANSYS Fluent. However, the material constant and operational parameters seems unrealistic, e.g., the temperature of 500 K on the irradiated wall, the incident light intensity (irradiance) several time higher than the solar irradiance. A real data from a real device would improve this work substantially.	

<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>	
The thesis, mainly its structure, looks very well. The motivation for such a work is well explained, number of references is adequate. The critical evaluation of simulated results (mainly its validation), was out of the scope of this thesis.	

<b>Formal and language level, scope of thesis</b>	<b>D - satisfactory.</b>
<i>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?</i>	
The level is good, but not equally high along this thesis, e.g. the chapters 1 – 6 are rather short and missing a common purpose. The chapter 14. Conclusion should be written with more attention, more specifically about the work done by the author (it is not necessary to repeat general sentences). Last 2 comments: on page 17, there is written ... <b>introductory</b> conditions... (instead of <b>initial</b> conditions), and on page 41, there is mentioned <b>Beer-Lambert law</b> with inconsistent notation and without a comprehensive description (making some relation to the equations implemented in ANSYS).	

<b>Selection of sources, citation correctness</b>	<b>D - satisfactory.</b>
<i>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?</i>	

Citation ethics: This rather delicate point, i.e. how clearly are distinguished the propre results from that taken from the literature (or supervisor), is not entirely well treated, e.g. the work of Filip R. (2019), author's predecesor is not cited although his scheme, Figure 3, was taken (accompanied with wrong citation). Moreover, there is another wrong citation, Figure 4 was taken from the work of this rewiever.

### **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.*

Please insert your comments here.

### **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, mainly its structure, looks very well. This work represents the first attempt towards employing CFD code ANSYS Fluent for simulation of light propagation in algae photobioreactors. The discussion about the comparison of suitable radiation models for this task is a complex problem deserving further work and surely a real photobioreactor (and experimental data measured on it) for CFD results validation. However, the first step has been made.

Questions:

1. Does the Figure 3 show a macro- or micro-algal culture?
2. Could you explain why you did not use more realistic temperature for bioreactor's irradiated walls?
3. Knowing the experimental set-up (bioreactor dimensions and operating conditions) and the results of irradiance measurement, e.g. on the left (irradiated) and right walls of flat panel photobioreactor, could you propose how these results would be used for model parameters identification?

The grade that I award for the thesis is **C - good**.

Date: **18.8.2020**

Signature: