

I. IDENTIFICATION DATA

Thesis title:	Assessment and Comparison of Mathematical Models for Thermal Conductivity and Dynamic Viscosity of Refrigerants Superheated Vapour
Author's name:	Monilkumar Nalinkumar DABHI
Type of thesis :	bachelor
Faculty/Institute:	Faculty of Mechanical Engineering (FME)
Department:	Department of Environmental Engineering
Thesis reviewer:	Ing. Martin Barták, Ph.D.
Reviewer's department:	Department of Environmental Engineering

II. EVALUATION OF INDIVIDUAL CRITERIA

Thesis topic	challenging
<i>How demanding was the assigned project?</i>	
The aim of the submitted thesis is evident from its title. The most important part of the thesis is based on a literature review. A proper review of literature is time demanding process. It requires insight to the studied filed and sufficient analytical skills. The topic difficultness is certainly appropriate for the bachelor level of study.	

Fulfilment of assignment	unfulfilled
<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 thesis assignment consists of two main tasks: (1) to review the literature about calculation models for thermal conductivity and dynamic viscosity of refrigerants at the state of superheated vapour; (2) to assess the found calculation models by comparing them with reliable data.	
The 1 st task was elaborated with the use of only 7 publications, other items on the list of references were just briefly mentioned and almost half of them were not mentioned in the text at all. This is not adequate for a proper literature review. More details can be seen in the parts "Methodology" and "Selection of sources, citation correctness" of this review.	
The 2 nd task, i.e. the assessment of the selected calculation models is based on some "reference" data set which is not specified or described. Without knowing what the "reference" is, it is impossible to assess the quality of outputs from this task. The presented model equations and graphs showing the comparison between models and the "reference" data are incomplete. The so-called statistical analysis (Chapter 4) is based on questionable criteria. The task outputs are not reproducible and their quality cannot be assessed in any way due to lack of information provided by the author.	

Methodology	incorrect
<i>Comment on the correctness of the approach and/or the solution methods.</i>	
Task 1 (literature review)	
In general, I am missing a systematic and structured approach to the literature review. First of all, I would expect some classification of the calculation models and description of their advantages and disadvantages. Based on this classification, some category might be selected as appropriate for the purpose of this thesis. The selection of literature sources and consequently of the calculation models seems to be rather random than systematic. Also the number of literature sources which were really analysed is quite low, i.e. seven (out of them 3 are irrelevant – see below). Therefore, the presented selection of calculation models is questionable.	
Many pages of the thesis are devoted to methods which are not applicable in the context of the current project. For example, about 7 pages (8-15) present methods [ref. 1] which are finally evaluated as not appropriate for practical use (p. 15). It is obvious that the use of the equation (13) for superheated vapours is not justifiable as it is declared by the original author to be suitable for "thermal conductivity in the liquid saturated state" [ref. 7]. Application of the equations (16), (17) and (18) requires a set of 9 coefficients which are different for different refrigerants (p. 23). Therefore this approach [ref. 17] is not applicable without having experimental data.	
(continues on the next page)	

Methodology (cont.)

Task 2 (assessment of calculation models)

The list of 10 refrigerants which were used to assess the calculation models is on the page 24. It is not clear how these refrigerants were selected. The superheated vapour regions for these refrigerants are not specified. The calculation models are compared with a data set denoted as 'reference' without any specification. Any assessment based on unknown 'reference' is worthless. The so-called statistical analysis (Chapter 4) consists in 17 pages of mean values and deviations (without physical units) which are not described at all. It is not clear how these values correspond to good or bad performance of calculation models.

Technical level

F - failed.

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?

The technical level of the thesis is very poor. The equations are presented without physical units and many times without description of all symbols. The specification of units is important since the presented equations are mostly semi-empirical correlations which frequently use derived units. Without the description of all symbols the equations are useless for potential further work. The problem of missing physical units occurs repetitively in the whole Chapter 4 – Statistical Analysis. The reduced temperature is in kelvins according to the list of symbols (p. 6) but it should be dimensionless (e.g. p. 16, 24). Absolute deviation cannot be quantified in percentage (p. 12, 17 and 24). There are only static data but no equations in the appended Excel file. The numerical values in the Excel file concern only 'mean values' and 'standard deviations', there are no values of physical properties. The Excel graphs are linked to an unavailable data source: a file which exists in the student's computer only. Since the description of presented calculation models is confusing and incomplete, it is not clear whether the author really understands what he tries to explain. From the graphs and the appended Excel file it is not possible to assess the quality of calculation procedures and the reliability of obtained values of dynamic viscosity or thermal conductivity. The outputs of the thesis might be correct but also completely wrong.

Formal and language level, scope of thesis

E - sufficient.

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 printed and electronic (PDF) versions of the thesis do not seem to be identical. The main part of the thesis in printed version has 51 pages while the same part in PDF version has 52 pages. 23 literature references are listed in printed version while 25 references are presented in PDF version. The printed thesis text consists of 53 pages including the list of references. Based on his own literature review, the author selected a number of equations which should be applicable for calculations of dynamic viscosity (3 equations) and thermal conductivity (2 equations) of some refrigerant superheated vapours. These calculation models are compared with the data set which is in the thesis denoted as "reference". The comparison is presented on 140 graphs printed on 47 pages. The language style is quite clear and understandable. However, there are unnecessary mistakes which indicate that the author has not checked the text for errors. Some excerpts from the literature should have been captioned as tables rather than figures (Fig. 3, 4 and 5). Equations should be referred to by their numbers in brackets, e.g. equation (19). The graphs presenting the comparison of calculation models with the reference data should have fully specified quantities on both axes. "Viscosity" and "Conductivity" is not enough, it should be "Dynamic viscosity" and "Thermal conductivity", respectively. Both axes of each graph should show the physical units; besides the mentioned physical properties, this concerns also temperature on the horizontal axis. The graphs no. 3, 42, 44, 46, 48 and 50 have incorrect scale on their vertical axes. The graphs no. 101-110 do not have any quantity specification on their vertical axes. It would be much better to put the type of refrigerant into the title of each graph. It is very inconvenient for a reader to make the link between the descriptions on pages 31-48 and corresponding graphs.

Selection of sources, citation correctness

F - failed.

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?

According to the list of references in the PDF version of the thesis, the literature review is based on 25 publications. However, only 7 of them ([1], [7], [14], [15], [17], [19] and [23]) were used, analysed or commented in some details. On the other hand, 11 publications on the list ([2], [3], [4], [9], [10], [11], [13], [16], [21], [24] and [25]) are not mentioned anywhere in the text. Therefore the list of references does not seem to be trustworthy. The literature references do not follow any valid standard of presentation. They are listed in an unusual format which does not provide full information; for example, there are no indications about the type of publication (book, journal paper, conference paper, etc.), there is no specification of the year of publication. Therefore, to find the literature sources listed in this thesis would be difficult. This could be a problem in the case of further exploitation of the thesis.

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 skilfulness, etc.

My impression is that the thesis was elaborated in a way which is rather chaotic, perhaps because the student did not allocated enough time for his work.

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 defence of the student's work.

My overall impression is that the thesis was elaborated in a too short time, in a superficial way, without careful work on the manuscript. The text as well as the presented equations and graphs are disordered, incomplete and thus confusing rather than explaining the subject of research. The output quality is not sufficient for the final year bachelor student at the Faculty of Mechanical Engineering, CTU in Prague. My opinion is that the current thesis is not defensible and it needs major revision and corrections.

The grade that I suggest for the thesis is: **F - failed.**

During the thesis defence I would like the student to answer the following questions:

1. What is the meaning of "mean value" and "standard deviation" which are presented in the Chapter 4 – Statistical Analysis?
2. Are the above criteria relevant for the evaluation of the selected mathematical models? What other criteria could you use?
3. What was used as the "reference" data set presented in the graphs (Appendix 1 to 140)?

Date: 15th August 2022

Signature: