THESIS REVIEWER'S REPORT

I. IDENTIFICATION DATA

Thesis title:	**The transformation between GNSS ionospheric models**
Author's name:	**Yaroslav Kulesha**
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Measurement
Thesis reviewer:	Ing. Petr Kacmarik, Ph.D.
Reviewer's department:	AZD Praha

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	**ordinarily challenging**

How demanding was the assigned project?

Ionospheric delay is one of the main sources of error in single-frequency satellite positioning. Such errors are usually mitigated by ionospheric models. The aim of this thesis is to propose a method that allows coefficient transformation between the two main models currently in use, the Klobuchar model and the NeQuick-G model.

The achievement of this objective requires a study of ionospheric phenomena, a study of both models, which are based on different principles, and finally, to propose the methodology (method) of coefficient transformation between the two models. In my opinion, the transformation of the ionospheric model is challenging enough to be assigned as a Master's thesis topic.

Fulfilment of assignment	**fulfilled with major objections**

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.

The successful fulfilment of the thesis objective supposes the study of both models. The thesis proves that this part was done at the appropriate level.

My main objection concerns the method for transforming the coefficient model, which should be the main achievement of the work. The transformation is covered in section 3.9. The student analysed two approaches to transformation, linear regression and the use of feed-forward neural network. Unfortunately, this main work of the thesis is very poorly described, it is not clear how certain methods were used, which available tools were used or which tools were prepared by the student for the transformations performed, and based on what evidence (results) the student came to the conclusion about both methods.

Sec. 3.9.1 is extremely short. Sec. 3.9.2 is unclear, contains figures and diagrams which are not explained in the text and do not help with understanding of what has been done.

There is no doubt that the student really worked on the coefficient transformation, but the results, at least in the form currently provided, are hardly usable.

Methodology	**correct**

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

I have no major comments on the chosen approach and methods, I find them appropriate for the purpose of the thesis.

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?

The theoretical part (Sec. 2), which describes both models on the basis of information from various sources, is well prepared. From Sec 3.1 onwards the description becomes poorer, and finally, Sec. 3.9, which should address the main achievement of this work, is inadequate for the reasons I have mentioned under the "Fulfilment of assignment" paragraph.

Formal and language level, scope of thesis	B - very good.
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 structure of the thesis could be improved, but this is not serious. E.g. Sec. 3, which should mainly deal with the student's own work, should fully rely on the source studies provided in Sec. 2. However, theoretical topics such as GNSS constellation or linear regression and neural networks are not mentioned in Sec. 2, but these topics are mixed with the student's own work in Sec. 3.

I would also point out, that the references are usually introduced with a class of such reference (Sec., Fig., Tab.). E.g. "… coefficients for random 10 days are presented in 3.7" should be "… coefficients for random 10 days are presented in <u>Table 3.7</u>". This shortage is spread across the whole thesis (valid for Sec., Fig. and Tab.).

Selection of sources, citation correctness	B - very good.
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 reference list (bibliography) seems appropriate for the scope of the thesis. References to the sources have been provided in the thesis text at a sufficient level.

However, I would expect that whenever a figure is borrowed from any source (which is the majority of figures in the thesis), then the sources would be explicitly included in the figure title.

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.

I have no comments other than the above mentioned.

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 main objection to this thesis has been described in paragraph "Fulfilment of assignment", i.e. the approach to the model coefficient transformation is poorly described and it is unclear how the student arrived to the conclusions.

I would suggest that this issue will be properly addressed and explained during the defence of the thesis.

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

Date: **8.6.2024**   Signature: