CTU
CZECH TECHNICAL UNIVERSITY IN PRAGUE

THESIS SUPERVISOR'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:	Measurements
Thesis reviewer:	Pavel Kovar
Reviewer's department:	Radioelectronics

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment **challenging**

How demanding was the assigned project?

The diploma thesis requires the study of complex theories concerning the ionospheric delay models. A successful solution requires the application of advanced mathematics and statistics.

Fulfilment of assignment **fulfilled with minor 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 student fulfilled the assigned task by approximately 80%. Better results would be achieved if the student respected the supervisor's advice and postponed the thesis's finalization until autumn.
The text of the report is very brief; the essential information is missing. The presentation of the resulting transformation algorithm is insufficient. The paragraph with clear functions or algorithms that transform three NeQuick parameters to eight Kolbuchar parameters and vice versa is missing.

Activity and independence when creating final thesis **C - good.**

Assess whether the student had a positive approach, whether the time limits were met, whether the conception was regularly consulted and whether the student was well prepared for the consultations. Assess the student's ability to work independently.

The student worked too independently. On the one hand, he studied the problem and proposed a solution individually. He needed only consultation concerning the solution of the Kepler equation.
He resolved non-trivial problems of uniformly distributing points on the sphere and many others.
On the other hand, the transformation algorithms are not finished at 100% but only at 80%.
The thesis text is very brief and too short. In addition, he repeated some commonly known information many times.
For instance, the layered approach of the Nequick model is repeated many times while detailed information is missing. For example, the student applied a third-party C code that implemented the model. The essential details in the text are absent.
The first and last thesis text was sent to the supervisor on 25 May. The supervisor has no chance to correct them. The advice for prolongation of the study with the aim of thesis finalization was not reflected by the student.

Technical level **C - good.**

Is the thesis technically sound? How well did the student employ expertise in his/her field of study? Does the student explain clearly what he/she has done?

The student independently and correctly solved the problem, but the solution was not finalized to 100%.
The thesis does not contain paragraphs with clear descriptions of the transformation algorithms.
The author did not clearly define the optimality criterion; for example, minimalization is the least square error of position differences in the test points.
Model transformation can be realized by several methods: brute force, curve fitting, or some optimization bias for a traditional approach or on AI.
The author can compare the live Klobuchar and NeQuick coefficients transmitted by a GPS and Galileo. We have available two months of measurements.

In paragraph 3.9.1, "Linear regression with ridge regularization", the author wrote: "This method splits the data into training and testing sets, performs correlation analysis, and selects features based on correlation coefficients." It is not clear which data. The author has the satellite position date and coordinates of test points only.
It seems that the student processed some Rinex data for some unknown reason.
The same problem is in paragraph 3.9.2 Neural network. The student wrote: "The model was trained on all available data".

Formal level and language level, scope of thesis **C - 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?

Language is OK, but essential information is missing. The orientation in supplements is difficult as the description is missing.

Selection of sources, citation correctness **A - excellent.**

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?

OK, no comments.

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.

No comments

III. OVERALL EVALUATION, QUESTIONS FOR THE PRESENTATION AND DEFENSE OF THE THESIS, SUGGESTED GRADE

The student should clarified the paragraph 3.9.1. and 3.9.2. Which data was processed and why, see comments in technical level section.

Summarize your opinion on the thesis and explain your final grading.

The student has done a lot of work. He successfully developed software for test point distribution and satellite position calculation; he implemented the Klobuchar and NeQuick models, i.e. all necessary things for transformation between models. Unfortunately, the final algorithm is missing or not adequately described. The thesis is too short, and many essential information is missing. I recommend the thesis for the defence and grade it C – Good.

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

Date: **7.6.2024** Signature: