I. IDENTIFICATION DATA

Thesis name:	**The mathematical model of the functioning of the thyroid gland**
Author's name:	**Ekaterina Fadeeva**
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Computer Science
Thesis reviewer:	Associate professor Makletsov Sergey Vladislavovich, Ph.D
Reviewer's department:	Kazan Federal University, N.I. Lobachevsky Institute of Mathematics and Mechanics, Department of Theory of Functions and Approximations

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	**challenging**

Evaluation of thesis difficulty of assignment.

In the Master Thesis is considered the problem of construction of mathematical model of thyroid gland as a mega-system consisting of follicles. To date, mathematical modeling is actual topic. In this work is used CUDA technology to quickly solve the system of ordinary differential equations for the number of follicles about 2 million. The built-in random number generator and methods of solving the system have also been investigated. The quality of the generated sequence, the accuracy of the methods and the speed of operation affect the further possibility of using the data. All research point to the difficulty of the task.

Satisfaction of assignment	**fulfilled**

Assess that handed thesis meets assignment. Present points of assignment that fell short or were extended. Try to assess

importance, impact or cause of each shortcoming.

The author explores the problem of building a mathematical model of the thyroid gland. In this work was constructed a model of a separate thyroid follicle was constructed. This model shows the dependence of changes in follicle size on the concentration of iodine input. Using CUDA technology, the model simulates the work of this thyroid gland at the cellular level. The thesis presents graphs of comparison of random number generators to create a starting sequence distributed by log-normal law. The author also carried out a comparative analysis of Euler and Runge-Kutta methods for solving a system of ordinary differential equations. In the analysis of the work were studied ways to accelerate the calculations through the use of individual methods. In general, the dissertation was carried out on a high level, but the model itself does not take into account some chemical reactions and requires improvement.

Method of conception	**correct**

Assess that student has chosen correct approach or solution methods.

The existing approaches to solving the problem were analyzed. Based on the existing solutions to the problems, the model was constructed and solved correctly.

REVIEWER'S OPINION OF FINAL THESIS

Technical level	**C - good.**

Assess level of thesis specialty, use of knowledge gained by study and by expert literature, use of sources and data gained by experience.

The author conducted a research of existing technologies and approaches to solving the problem. The author used the acquired skills correctly.

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

Assess correctness of usage of formal notation. Assess typographical and language arrangement of thesis.

The topic of the dissertation good analyzed. Theoretical part of the dissertation is written clearly. A large number of images and tables make the results more understandable. However, some sentences are too long, which makes it difficult to perceive this information in the text.

Selection of sources, citation correctness	**B - very good.**

Present your opinion to student's activity when obtaining and using study materials for thesis creation. Characterize selection of sources. Assess that student used all relevant sources. Verify that all used elements are correctly distinguished from own results and thoughts. Assess that citation ethics has not been breached and that all bibliographic citations are complete and in accordance with citation convention and standards.

The sources have been selected correctly and are quoted correctly. Not only articles but also textbooks on anatomy were used to explain the work of the thyroid gland, which is very good for this work. There are not enough sources that work.

Additional commentary and evaluation

Present your opinion to achieved primary goals of thesis, e.g. level of theoretical results, level and functionality of technical or software conception, publication performance, experimental dexterity etc.

Judging by the results, the task was completely solved. The model evaluation showed good results. The use of CUDA technology allows controlling the number of thyroid follicles, which allows testing this model for different animals.

III. OVERALL EVALUATION, QUESTIONS FOR DEFENSE, CLASSIFICATION SUGGESTION

Summarize thesis aspects that swayed your final evaluation. Please present apt questions which student should answer during defense.

The thesis, in its content, corresponds to the chosen topic and tasks. However, some questions are remained open:

1. How can the mathematical model of the thyroid gland be improved?

2. Is it possible to apply this model in practice?

I evaluate handed thesis with classification grade **B – very good.**

Date: **29.5.2020**   Signature: