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Skolkovo Institute of Science and Technology

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Lyudmila Khakimova

PhD Program: Petroleum Engineering

Title of Thesis: New approached for numerical modeling of air-injection based enhanced oil recovery

Supervisor: Associate Professor Alexey Cheremisin

Name of the Reviewer: Dmitry Koroteev

I confirm the absence of any conflict of interest	**Signature:** **Date: 11-11-2020**

The purpose of this report is to obtain an independent review from the members of PhD defense Jury before the thesis defense. The members of PhD defense Jury are asked to submit signed copy of the report at least 30 days prior the thesis defense. The Reviewers are asked to bring a copy of the completed report to the thesis defense and to discuss the contents of each report with each other before the thesis defense.

If the reviewers have any queries about the thesis which they wish to raise in advance, please contact the Chair of the Jury.

Reviewer's Report

Lyudmila Khakimova's PhD thesis covers numerical modeling of air injection to an oil reservoir to increase the oil recovery coefficient.

The thesis is structured well and saturated with high-quality research data. The topic links well to the actual content overall. The methods used for simulation (CMG + advanced PVT description of the fluid system) are up-to-date. The validation and verification data is unique and represents the combustion tube tests.

The results are definitely on the top-notch of the overall international level in the area of gas-driven enhanced oil recovery. The outcome of the research could well be applied in practical reservoir engineering. I am impressed by the multi-GPU numerical implementation of the anisotropic elastodynamic equations allowing to "simulate in a few seconds wave fields for model domains involving more than 1.5 billion grid cells."

The publication record is solid and includes more than three publications in Q1 journals like the Journal of Petroleum Science and Engineering and Geophysical Journal International.

There are some issues and questions to be addressed before and during the thesis defense.

1. “Error! Reference source not found” issues and quite a lot of typos in the text

2. Description of experiments takes a significant part of the thesis whilt the thesis is titles as “numerical modeling…”. Why so?

3. Straightforward practical application of the results is limited because the information about the possible upscaling routines is nearly absent in the text. Why so?

4. The link of the main topic with the development of the multi-GPU implementation of the anisotropic elastic equation is not obvious.

Overall, I do recommend the thesis for the PhD defense. I believe that Lyudmila deserves PhD title.

Provisional Recommendation

☒ *I recommend that the candidate should defend the thesis by means of a formal thesis defense*

☐ *I recommend that the candidate should defend the thesis by means of a formal thesis defense only after appropriate changes would be introduced in candidate’s thesis according to the recommendations of the present report*

☐ *The thesis is not acceptable and I recommend that the candidate be exempt from the formal thesis defense*