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# Jury Member Report – Doctor of Philosophy thesis.

**Name of Candidate:** Markovic Strahinja

**PhD Program:** Petroleum Engineering

**Title of Thesis:** Application of LF-NMR measurements for characterization of unconventional hydrocarbons using machine learning

**Supervisor**: Professor Alexey Cheremisin

**Name of the Reviewer:**

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| I confirm the absence of any conflict of interest<br><br><br>(Alternatively, Reviewer can formulate a possible conflict) | **Date: 25-07-2022** |

*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**

Reviewers report should contain the following items:

- Brief evaluation of the thesis quality and overall structure of the dissertation.
- The relevance of the topic of dissertation work to its actual content
- The relevance of the methods used in the dissertation
- The scientific significance of the results obtained and their compliance with the international level and current state of the art
- The relevance of the obtained results to applications (if applicable)
- The quality of publications

The summary of issues to be addressed before/during the thesis defense

The thesis is rather well written and contains a number of novel and interesting results. The topic is fully relevant to its actual content. Both oil viscosity and water saturation determination, based on LF NMR measurements, are important for development and application of different EOR technologies. The author employed a number of modern methods relevant to the dissertation's objectives. It is worth to emphasize that both experimental techniques and machine learning methods were professionally used. The results obtained are scientifically significant and correspond to the international level of the modern petroleum engineering. This level is demonstrated by the high-quality publications. Most of the results obtained are readily applicable to solving practical engineering problems. The major results have been published in the top academic journals that confirms high scientific level of the work accomplished.

**Specific comments**

1. Typo in Eq. (8). Numerator and denominator are traded places.

2. The correlation for oil viscosity (Eq.24). The author employed more parameters than the other investigators mentioned in the thesis.
   Can the author be sure that the model is not overfitted?
   Has the author verified model performance using not his experimental data but those obtained by other researchers?
   This issue has to be clearly explained in the thesis.

3. For obtaining the viscosity model parameters, the author used the approach based on the least square mean difference technique.
   Such an approach is questionable because it is claimed that the correlation obtained is applicable for a wide range of viscosities, whereas the least square technique to a significant extent ignores a contribution of small viscosities into the model.

   This issue has to be explained in the thesis.

**Provisional Recommendation**

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| ☒ *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* |

Dmitry Eskin

Professor,

Center for Petroleum Science and Engineering