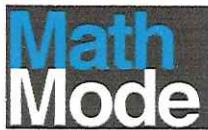


17 -11- 2020

lks



Bilbao, October 25th, 2020

FROM: Prof. David Pardo

University of the Basque Country, BCAM, and Ikerbasque Research Professor
Department of Applied Mathematics, Statistics, and Operational Research
Barrio Sarriena S/N, 48940 Leioa - Bizkaia - Spain
Ph.: + 34697373668. E-mail: dzubiaur@gmail.com
<https://sites.google.com/view/mathmode/home>

TO: AGH University of Sciences and Technology, Krakow, Poland

RE: **Review Report of PhD Dissertation of Grzegorz Gurgul, entitled:**
***"DESIGNING DISTRIBUTED ALTERNATING-DIRECTIONS SOLVERS FOR
ISOGEOMETRIC FINITE ELEMENT METHOD ANALYSIS"***

Dear Scientific Discipline Board for Information and Communication Technology at
the AGH University of Science and Technology,

In the following, I provide my review report of the Ph.D. Dissertation of Mr. Grzegorz
Gurgul.

Summary

In his Ph.D. Dissertation, Mr. Grzegorz Gurgul explores and analyzes the use of
cloud computing for performing advanced numerical simulations based on a specific
numerical method: a time-dependent Alternating Directions Implicit (ADI) solver that
employs Isogeometric Analysis (IGA) discretizations. He refers to this method as
IGA-ADI.

The author also illustrates via numerical experimentation the scalability he obtains
for the IGA-ADI method in two different cloud computing architectures.

Main Accomplishments

The main accomplishments of this PhD Dissertation are:

- **Mr. Gurgul is able to clearly show the advantages of using cloud computing for IGA-ADI simulations.** In particular, he is able to show a rather good scalability up to a certain number of threads (around 100-200). This is an important and original contribution.
- Mr. Gurgul provides a scientifically profound and in-depth discussion of how to implement IGA-ADI in a cloud computing environment. Some of the ideas

discussed in this Dissertation could be extended to the cloud-computing implementation of other numerical methods.

- Mr. Gurgul shows a large number of numerical examples illustrating the performance of the IGA-ADI method. These results focus both on high performance (scalability, etc.) and also on accuracy and stability, thereby, providing a full picture of the analyzed numerical method.
- Mr. Gurgul has published one article in a Q1 journal and two other articles in a Q2 and Q3 journals, respectively. He is the first author of the Q1 and Q3 journal publications. He has also delivered several presentations in good conferences worldwide.

In my opinion, the previously mentioned novel contributions are sufficient to grant Mr. Gurgul a Ph.D. degree in Information and Communication Technology.

Other Aspects of Mr. Gurgul Ph.D. Dissertation

In the following, and based on the submitted Ph.D. Dissertation, I provide a list of suggestions and ideas that aim at helping Mr. Gurgul with his future career.

1. I suggest Mr. Gurgul to preserve an overall good organization in his written documents, as the one exhibited on his Ph.D. Dissertation. Some improvements could include removing some paragraphs on the conclusions that do not correspond to actual conclusions of the performed work. Other improvements include re-organizing the introduction in a more classical format where the organization of the document is located towards the end of the introduction.
2. I suggest Mr. Gurgul to preserve a good writing in English, as the one he exhibits in his Ph.D. Dissertation. Perhaps some improvements include the use of commas and the exchange in several places between the words “that” and “which”. I also suggest him to use a more direct language employing shorter phrases with more clear and precise ideas. Sometimes, it is difficult to grasp some of the ideas mentioned by the author, despite being written in good English. An example of this is the abstract, which I find unclear/unfocused. A shorter and more focused abstract would be preferred. It currently lacks precision. Also, more quantitative and precise comments are preferred over qualitative and ambiguous phrases.
Examples of good phrases are those clearly stating the main contributions on page 22 of the Ph.D. Dissertation. Summarized versions of these phrases should be clearly stated earlier on, e.g., in the abstract.
3. I suggest Mr. Gurgul to preserve the use of good graphics, as the ones that illustrate this Ph.D. Dissertation. An exception is Fig. 2.3: fonts should be kept in PDF (rather than in jpg) and thicker curves should be employed to make it more attractive to the reader.
4. I suggest Mr. Gurgul to explicitly write the term “cloud computing” in the title of some of his articles/presentations. Only his last listed presentation makes it clear in the title the fact that he is working with such computer architectures.
5. I suggest Mr. Gurgul to use a format for listing presentations and publications that complies with international standards and it is easier to read than the one presented towards the end of his Ph.D. Dissertation.

6. I suggest Mr. Gurgul to make extra efforts to publish in Q1 journals rather than in lower-ranked journals. Even if this lowers his overall production. His work is high-quality and eligible for Q1 journals.
7. In page 33, Mr. Gurgul claims that multi-frontal solvers work with positive definite matrices. But they are indeed used with a much larger family of matrices (non-singular matrices). However, when matrices are non-positive definite, pivoting becomes more essential. And this may severely affect some of the conclusions of the work, like the use of elimination trees, which may need to be reordered due to pivoting. I am missing a discussion or remark about this.
8. I suggest Mr. Gurgul to explore or at least anticipate in the future work his beliefs about how other numerical methods could benefit from cloud computing. In particular, I wonder if a more expensive numerical method could scale properly to a large number of threads (e.g., 1000 or more) using cloud computing.
9. Numerical results like those contained in Fig. 6.12 are highly illustrative. Moreover, this is a self-contained graphic: it is easy-to-understand, without having to read the rest of the document. It is important that in your future documents you illustrate the theory with results and graphics like this one. Congratulations.

Final Recommendation

In conclusion, it is my belief that Mr. Grzegorz Gurgul Dissertation and Scientific Achievements constitute a significant contribution to the field of Information and Communication Technology and fulfills the requirements for a Doctoral Degree according to the current Polish law.

Therefore, I recommend his Dissertation to be considered for the highest possible recognition on the field and to be admitted for further procedural stages.

Sincerely,



DAVID PARDO



David Pardo, Ph.D.

UPV/EHU, BCAM, and Ikerbasque Research Professor at the

Department of Mathematics, University of the Basque Country

(UPV/EHU)

A Barrio Sarriena S/N, Campus de Leioa, 48940 Leioa, Spain

M (+34) 697373668 E dzubiaur@gmail.com

W MATHMODE Group

Math
Mode

ermon to zahel zaku

UPV EHU