

IT4Innovations National Supercomputing Center
VŠB-Technical University of Ostrava
Studentská 6231/1B
708 33 Ostrava – Poruba
Czech Republic

To: FIT Brno University of Technology

Ref: Review of the habilitation thesis “High performance computing in ultrasound cancer treatment” by Ing. Jiří Jaroš, Ph.D.

October 1st, 2017

Jiří Jaroš has been involved in the development of the k-Wave acoustic toolbox for 6 years with the goal to use it by clinicians for HIFU treatment planning and photoacoustic imaging on everyday basis. This software is used by almost 8000 registered users in 60 countries from both academy and industry. It became quickly standard in the field of ultrasound and photoacoustics.

Contributions of Jiří Jaroš:

1. The development of the acoustic model considering nonlinearity, heterogeneity, and abstraction.
2. The design, development, and deployment of various simulation codes on platforms ranging from laptops up to top supercomputers.
3. Novel decomposition techniques for spectral methods improving the performance and keeping the accuracy.
4. The support of several research teams in their clinical studies on the prostate, kidney, liver, or in the brain.

I personally appreciate:

1. Enabling the use of the largest supercomputers such as Piz Daint and Titan for different application studies and thus significant acceleration of the simulations.
2. Wide user community of k-Wave.
3. Nice English with minimum number of typos.
4. Combination of mathematical methods and HPC.
5. Significant practical applications such as salvage HIFU treatment in the prostate and transcranial ultrasonic neurostimulation.

6. All important parts of the thesis were presented at the prestigious IEEE conferences and they are published in articles in journals with high impact factor (Medical Physics IF 2.5, IEEE Transactions on Biomedical Engineering IF 2.5, Journal of Systemics, Cybernetics and Informatics IF 2.85, etc.).
7. Increasing number of citations.
8. Leading more than 50 bachelor and master thesis and teaching focused on HPC architectures and parallel programming.
9. PI of FP7 and H2020 projects (PAMMOTH, BrainWave, CRESTA, ...).
10. Membership in programme committees of the international conferences (ICCS, MUSEPAT, ICONS).

Questions:

1. Comparisons in thesis are done all the time with fully optimized k-Wave toolbox?
2. Page 25: Have you tested scalability behaviour over 6144 processor cores?
3. What about the energy-efficient version of k-Wave?
4. Which strategy will be used for parallelization in time?
5. Why has been the cooperation with HPC group at ANU focused on the development of k-Wave stopped?

The scientific work done by Jiří Jaroš is original and of high level in the field of he habilitation program. It enabled to move the research in ultrasound and photoacoustics forward. According to the above-mentioned, I confirm that habilitation thesis and the applicant's scientific and pedagogical competence correspond to the requirements of the procedure for awarding him by academic degree of associate professor according to § 72 paragraph 5 of Act No. 11/1998 Coll., On Higher Education Institutions.

Best regards,



Prof. Ing. Tomáš Kozubek, Ph.D.

Scientific Director of IT4Innovations