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Different Approaches for Elastic Imaging using Multiprocessor Computing Systems

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At present, oil and natural gas form the basis of energy throughout the world. In view of significant depletion of reserves, the task of prospecting and exploration of new deposits is becoming increasingly important. In the industry the specific migration procedure is used to find contrast interfaces between geological layers with different properties. It should be noted that algorithms developed to date are constructed in the acoustic approximation of the medium, which leads to defects in migration images. In particular, subvertical boundaries are practically not restored. Prospective in terms of overcoming these shortcomings is the transition to a full elastic formulation of the tasks of seismic survey process. Despite rising computational complexity of the problem the goal can be achieved with the usage of modern HPC systems.

The work is the continuation of the previously reported research about the usage of Born approximation as a new elastic imaging method. In this study different fundamental approaches were used. Born approximation and Kirchhoff approach were adopted to 2D and 3D elastic problems in the case of homogeneous background medium. The research software in C++/Mathematica was developed, and a set of calculations for simple geological models were carried out using multicore shared memory system. The assessment of the scalability shows high effectiveness.

Summary

The research software based on the new elastic imaging methods using different approaches: Born approximation, Kirchhoff approximation and full-wave simulation method was developed. The assessment of the scalability on multi-cores shared memory system shows approximately 90 % of effectiveness.

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