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# The Usage of HPC Systems for Simulation of Dynamic Earthquake Process

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Nowadays the HPC systems are very widespread in the world. Due to their computational power it is possible to simulate with a high precision a lot of phenomena: drugs development, seismic survey process, hydraulic fracturing and multi-component fluid flow, human-human interaction, high-speed collisions in open space, tsunami and earthquake initiation. That is why the development of modern applied research software for multi-processors systems are important.

In the current work seismic waves generated during the earthquake process are considered. To describe precisely the dynamic behavior of the heterogeneous geological medium the 2D/3D full-wave system of elastic equations was used. Unfortunately, the analytical solution is available only for simple source and geometry of the area of interest. The grid-characteristic numerical method on curvilinear structured meshes was successfully applied. To achieve enough computational speed on large grids the research software designed by Khokhlov N.I. at MIPT was used. It is parallelized with OpenMP and MPI technologies with a good scalability up to thousands of CPU cores.

A low-parameteric numerical model of hypocenter was introduced. As a verification a set of calculations for simple geological models in 3D were carried out. In 2D/3D cases the process of earthquake initiation at shelf was simulated. The contact between water (acoustic approximation) and geological bottom of the sea (full-wave elastic approximation) was explicitly taken into account. The magnitude at hypocenter was estimated with the Richter scale. The obtained time-spatial distribution of elastic stresses may be subsequently used in problems of strength of structures.

## Summary

The new approach for taking into account the heterogeneity of geological massif during the earthquake process simulation was investigated. To carry out numerical experiments for reasonable time the research software with multi-core/multi-processors parallelization was used.

**Author:** Mrs GOLUBEVA, Yulia (MIPT)

**Co-author:** Mr GOLUBEV, Vasily (Moscow Institute of Physics and Technology)

**Presenter:** Mr GOLUBEV, Vasily (Moscow Institute of Physics and Technology)

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