

Review

on PhD dissertation of Arshyn Altybay on theme
“Development of high-performance parallel algorithms and software complex for modeling hyperbolic type equations with singular coefficients: tsunami and acoustic wave propagation”

The PhD dissertation of Arshyn Altybay “Development of high-performance parallel algorithms and software complex for modeling hyperbolic type equations with singular coefficients: tsunami and acoustic wave propagation” is devoted to the development of high-performance parallel algorithms and software complex for modelling hyperbolic type equations with singular coefficients.

This PhD dissertation has 3 main chapters investigating mathematical models and finite difference schemes for hyperbolic type equations with singular coefficients and parallel numerical algorithms solving those equations.

On chapter 1, the mathematical models of hyperbolic type equations with singular coefficients such as tsunami and acoustic wave equation are given. In this chapter, he investigates finite difference schemes for the equations to choose suitable schemes for further implementations. Also in this chapter, he presents proof of the existence, uniqueness and consistency of very weak solutions to the tsunami equation and justification by numerical modelling.

At the end of this chapter, he uses tsunami model to study the Caspian tsunami and, finally, carried out numerical modelling and made different predictions relative to the tsunami, reaching the shore, depending on the height of the initial wave.

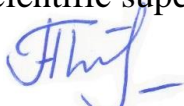
On chapter 2, three parallel numerical implementations of hyperbolic type wave equations are presented. In his implementations, he uses MPI, Open MP, CUDA technologies and obtains related computational results.

On chapter 3, the software complexes which he developed for investigation of wave equations with singular coefficients are described. The software package is very useful for the numerical study of one-dimensional and two-dimensional wave equations with different four singular coefficients and it is open-source, cross-platform, and written in Python programming languages.

All the main results are published in peer-reviewed international and local scientific journals.

Considering significance and novelty of the obtained results, in my opinion, this PhD dissertation satisfies all the requirements and its author deserves the degree of PhD in specialty “6D075100 - Computers Science, Computer Engineering and Management”.

Scientific supervisor



Niyaz Tokmagambetov

October 09, 2020