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ADVANCED COMPUTATIONAL TECHNIQUE IN GEOPHYSICAL SCIENCES

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ABSTRACT

Waves are omnipresent in our environment, created from both natural and anthropogenic sources. The simulation of waves is among the topics of interest in many areas of science. Non-exhaustive examples include exploration and application in medicine, geophysics, and mechanics. This mini-symposium aims to open the discussion on the latest advances in the field of numerical simulation for imaging the Earth by wave equations. The main field of application is geophysical imaging which remains a significant challenge for oil industry. There is, however, also an appreciable drive for development due to a decreasing number of known hydrocarbon reservoirs and the increasing complexity of the geological profile of possible new reservoirs. To this end, oil engineers use numerical imaging to produce maps of the Earth that help geologists to decide if hydrocarbons might be inside the explored region. Numerical imaging is initialized from data that are composed of records containing the time arrivals of reflected waves by the explorable region of interest. Accurate numerical geophysical imaging is based on solutions of the full wave equations in heterogeneous media. For oil industry, a very popular technique of imaging is termed the Reverse Time Migration (RTM). It is able to locate reflectors into the Earth from the knowledge of arrival times of reflected waves. While RTM gives information on the kinematics of the Earth, the dynamics is characterized by the solution of the inverse problem. It is a problem that is difficult to

solve numerically because it is non linear and ill-posed. Both approaches share a crucial step that consists in solving direct problems and obviously, the accuracy of the solutions of the direct problems impacts strongly on the capability of solving the inverse problem accurately. Development for improved simulation include modeling, construction of numerical schemes, design of meshes, high-performance computing. The objective of this mini-symposium is not only to provide a snapshot of the most effective methods for imaging the Earth but also to promote new ideas for discretization, resolution or problem formulation. In particular, we intend to focus on finite element methods, up-scaling, higher-order time discretization, and regularization methods. We hope to provoke meetings between various communities and by this way, to promote exchanges of methodologies and to encourage cooperation.