Rigorous modelling of 3D wave propagation

Project leaders
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Research theme
Complex dynamics of fluids

Participants
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Cooperations
TUD Chem. Tech, Philips, Shell, NLR

Funded
SenterNovem, NLR, Nuffic
1st - 2nd 100% 3rd -

Start of the project
2001

Information
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Project Aim

The aim is to develop efficient parallel iterative solvers for the Helmholtz problem. In order to estimate the layered structure of the earth crust seismic methods are used. The layer structure is used as input for porous media flow simulations.

Progress

A special preconditioner has been developed, which in a special combination of Krylov subspace and multigrid methods has resulted in a hundredfold increase in computing speed for the Helmholtz equation, describing wave propagation. Application in seismics has been very successful, and has generated much interest from the oil exploration industry, especially after a comparison with an industrial code in an application to a practical problem posed by industry. For the first time, realistic three-dimensional applications become feasible. This has already been realized on a single-processor machine for medium-sized problems. The 3D code for the seismic simulation package has been parallelized. Furthermore, a comparison with analytic solutions will be made. The fast solver technique will be generalized to a finite element discretization of the Maxwell equations, for radar simulations.

Dissertations

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Scientific Publications

1. A.V. Kononov and C.D. Riyanti and S.W. de Leeuw and C.W. Oosterlee and C. Vuik. Numerical performance of a parallel solution method for a heterogeneous 2D Helmholtz equation. Computing and Visualization in Science, 11, pp. 139-146, 2008.