Survey of fast asymptotic grid-based methods for forward seismic modelling

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The principal objective is to localize and investigate implemented and currently available grid-based asymptotic seismic forward methods for application in realistic geological models. The conclusion may provide the basis for implementation and further development of suitable methods.

The main task in this project is to create a data base/overview over existing grid-based methods for solution of the wave equation. The activities include: literature study through Internet search in public geophysical catalogues and electronic article data bases and in addition through personal communication with vendors. The result of the work is an attempt at compiling some of the current literature and web sites available on the subject of fast asymptotic (i.e. approximated) grid-based methods for forward seismic modelling. All types of waves: body waves, surface waves, and waves in boreholes are considered. All methods published the last decades are evaluated, however, only methods, where the computer code is currently available will be considered for future use. The data base/overview will eventually include all existing methods for solution of the wave equation, including approximate methods as e.g. ray tracing and convolution-based methods.

Currently the quantitative result is 155 Journal articles referenced, 44 Web pages referenced, 19 Codes found on Web (all described in detail, the main part have been downloaded), and 4 E-mails send to vendors to ask for codes. The most important grid-based seismic forward modelling methods are: Finite Difference methods, Pseudo-spectral Methods, Spectral Element Methods, and FEM. The Finite Difference Method is only mentioned with a few code references since this method is considered well known. For the other three several codes written in Matlab, Fortran77/90, C++, or C are found.