# Time-domain modeling group

**Members of the group:**

**Vladimir, Ju-Won, Hanchen, Mahesh, Qiang, ?Oleg?**

**++Bingbing as an advisor**

**The goal:**

Develop an efficient, user friendly and easily scalable code for **forward and adjoint 3D anisotropic time-domain modeling** (with utilization of less computational effort, when less symmetry anisotropy including isotropic, or acoustic needs is invoked).

**Features:**

The code should be able to handle anisotropic media up to triclinic – most general case. At the same time there should be options to benefit from more simple physics – e.g. isotropy, VTI. The code should be easy to compile on Shaheen as well as on a single workstation.

**Acoustics:**

There is a special case of SOFI3D for acoustics, but we need to figure out its efficiency, capability to handle the anisotropic media and compare it with codes from Mahesh and Nabil. Maybe it will be a separate code with some features in common (e.g. Adams-Bashforth time stepping or similar PMLs).

From Mahesh: “My forward modeling code is acoustic isotropic modeling (MPI + openmp),  with 4th order in space and 2nd order in time FD scheme. The input output is madagascar type.“ Nabil will be able to tell us about his code in person.

**The workflow:**

As the basis SOFI 3D from Karlsruhe Institute of Technology will be taken as one of the most optimized, simple and up to date free staggered grid codes for visco-elastic isotropic modeling in time domain. The code is already installed on Shaheen.

We will have a separate folder in github repository for the branches of the code to keep it consistent.

**Necessary modifications:**

1. Allow for C\_ij inputs

This is the main modification which requires changing the heart of the code as well as renewed “anisotropic” CFL condition checking.

1. Allow for VTI costraints

Should allow to make the code more efficient for VTI media.

1. Make input and output Madagascar friendly –

rsf files for input and output. Headers reading should be automated. The output and input should be brought to the same grid with as small errors as possible.

1. Adjoint wavefield computation possibility.

It should become possible to propagate back in time the residues – using complicated source function not separable in space and time should be possible.

1. Successful implementation of the dot product test for a complex anisotropic model.

**Proposed actions:**

1. Vladimir is presenting the features of the code. Discussion of motivation what is every member of the group going to use it for and where he wants to contribute most?
2. Modifications plan according to the responsibilities:

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**Presumed responsibilities:**

Juwon, Vladimir and Qiang are going to use and extend elastic version.

We first extend SOFI3D for anisotropic modeling and then we can improve it for FWI. Qiang helps us to make the code Madagascar friendly.

Nabil, Hanchen and Mahesh – primarily acoustic applications, increasing the Madagascar friendliness.

Apart from this Hanchen might need elastic version for more realistic source estimation in microseismic. As the first part we could generate data for more realistic signals and moment tensor sources to be used for inversion in his code.

**Meetings:**

**We are going to have weekly meetings. The first one is on July 28th, 2016.**