

Software update of frequency-dependent AVO inversion toolbox.

Four programmes have been adapted from matlab code to C or C++ code which can be run under Linux or Seismic Unix environment.

(1) ppcoef.cpp

This is a C++ program that uses the Chapman squirt-flow model (2002) to calculate the frequency-dependent reflection coefficient at the interface of a two-layer model. The upper layer is an isotropic medium, and the lower layer is an isotropic medium saturated with fluid. Users can change the parameters to design their own rock physics model. The input parameters are defined in the par_ppcoef.txt file. The 11 parameters are as follows:

Vp Vs rho Vp0 Vs0 f0 rho0 por0 cd0 tau f1

The parameters are separated by space. Vp, Vs, rho are the P-wave velocity, S-wave velocity, and density of the upper medium. Vp0, Vs0, rho0 are the P-wave velocity, S-wave velocity and density of the lower fluid-saturated medium at frequency f0. por0 and cd0 The porosity and fracture density of the underlying medium. tau is the time scale parameter. f1 is the frequency at which the reflection coefficient is to be calculated.

(2) Animod.cpp

This is a c++ program for calculating the frequency-dependent anisotropic moduli of fluid-saturated media with mesoscale fractures using the rock physics model developed by Mark Chapman (2003). This program calculates and outputs five independent elastic moduli for specific fluid-saturated media with vertical fractures. The input model parameters are defined in the par_animod.txt file. The 9 parameters are as follows,

Vp0 Vs0 r0 f0 por0 cd0 tau0 fd f1

Vp0, Vs0, r0 are the P-wave velocity, S-wave velocity and density of the fluid-saturated medium at the initial frequency f0. por0 and cd0 are the porosity crack density of the medium. tau0 is the time scale parameter. fd is the crack density. f1 is the frequency at which the elastic tensor to be calculated.

(3) Suspww2d.c

This is a spectral decomposition program of 2D seismic data using the smooth pseudo Wigner-Ville method. The program is developed under the CWP Seismic Unix software package. Copy the 'spww2d' file to the SU directory. Then make the suspww2d.c file and install the method into the SU system. The following command is an example of calculating 20Hz equal frequency profile for data.sgy:

```
$ segyread tape=data.sgy verbose=1 endian=0 | segyclean >data.su
```

```
$ suspwv2d frout=20.0 <data.su>data20.su
```

(4) Sufavoinv.c

This function uses the smooth pseudo Wigner-Ville spectral decomposition method to calculate the frequency-dependent AVO inversion attributes. Users need to prepare the seismic amplitude data and its corresponding spectral decomposition data of 5 different frequencies, plus p-wave velocity. An example of using this code is as follows:

```
$ sufavoinv inSD0=IL1605.su inSD1=IL1605_30Hz.su inSD2=IL1605_10Hz.su inSD3=IL1605_20Hz.su inSD4=IL1605_40Hz.su inSD5= IL1605_50Hz.su inVP=IL1605_vp.dat >data.su
```