Computing a theoretical dispersion curve

From GeopsyWiki

This tutorial details all the steps needed to compute a dispersion with **gpdc**. Another more interactive way to compute dispersion curves is Gplivemodel.

Contents

- 1 Creating a model file
- 2 Computing the dispersion curves
- 3 Saving the dispersion curves
- 4 Plotting the dispersion curves
- 5 Going further
  - 5.1 Help about command line options
  - 5.2 Programming interface
    - 5.2.1 A C++ example
    - 5.2.2 Fortran interface
  - 5.3 Theoretical considerations

Creating a model file

Crete a text file (e.g. "test.model"):

```
# My first model: two layers over a half-space
# First line: number of layers
3
# One line per layer:
# Thickness(m), Vp (m/s), Vs (m/s) and density (kg/m3)
7.5  500  200 1700
25  1350  210 1900
# Last line is the half-space, its thickness is ignored but the first column is still mandatory
0   2000 1000 2500
```

All lines beginning with '#' are considered as comments and they are ignored. Several models can be chained in one single file, but no comment line is allowed between layers. Column separators can be either TAB or SPACE. The number of consecutive separators does not matter.

Computing the dispersion curves

To get the dispersion curve of Rayleigh fundamental mode:

```
gpdc Test.model
```

You get as output:

```
# My first model: two layers over a half-space
# First line: number of layers
# One line per layer:
# Thickness(m), Vp (m/s), Vs (m/s) and density (kg/m3)
# Last line is the half-space, its thickness is ignored but the first column is still mandatory
# 1 Rayleigh dispersion mode(s)
# CPU Time = 1 ms
# Mode 0
0.2 0.00107875907546066
0.209523150557933 0.00107907141898638
[...]
19.0909691332367 0.00525624231593241
20 0.00526288933387501
```

To compute Rayleigh higher modes (4 in this case) as well as the fundamental mode:

```
gpdc Test.model -R 5
```

To compute Love higher modes (4 in this case) as well as the fundamental mode:

```
gpdc Test.model -R 0 -L 5
```

To compute Love modes, you must set explicitly the number of Rayleigh to 0, it is one by default.

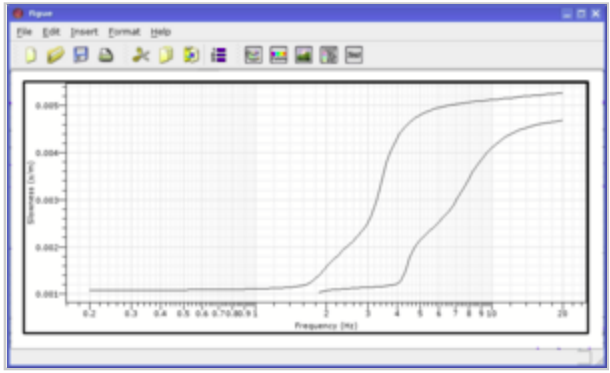
Saving the dispersion curves

```
gpdc Test.model -R 2 > Test_Rayeigh_2modes.disp
```

Plotting the dispersion curves

We use **figue** to plot couples of values (X, Y), additionally we provide a **make-up** file to get the correct type and labeling of axes. Before running the next command you can download Dc.mkup.

```
gpdc Test.model -R 2 | figue -c -m Dc.mkup
```



Dispersion curve plot with figue

Going further

Help about command line options

To get help about all options:

```
gpdc -h all
```

Programming interface

The computation of dispersion is implemented in *libQGpCoreWave.so* (or equivalent for Windows and Mac). You can access it through various languages: C++, C or Fortran. Complete examples are provided for C and Fortran in the source distribution archive. Download *gpdc* to have the simplest archive.

A C++ example