

Name	DISPCAL1
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This is a slightly more automated version of DISPCAL. The program analyzes a single data file containing the output signal of a seismometer during repeated stepwise displacements. The basic concept is described in the 'Handbook' and 'Manual' chapters on seismometry. An ASCII version of the text is included in this FTP directory as `abscal.tex`.

DISPCAL reads two input files: `dispcal.par` and a data file whose name is specified in `dispcal.par`. It generates nine output files containing intermediate signals generated in the analysis. By plotting these the user can follow the signal processing and determine reasonable values of the control parameters in the `dispcal.par` file.

The structure of the data file is as follows:

- one header line, arbitrary (will be echoed but not evaluated)
- additional header or comment lines whose first character is %
- one line containing the number of samples, the FORTRAN format in which they are listed, and the sampling interval. These three entries must be in the FORTRAN format (`i10,a20,f10.x`).
- data in the specified format

You may easily change this file structure in the source code.

The `dispcal.par` file has the following structure:

```
'stsl.abs'      name of the data file
'ST51-Z WET'   type and serial number of the seismometer
20.15          free period of the seismometer
0.68           fraction of critical damping
4.006          microvolts per count
2.000          displacement in millimeters per step
15.           determine trend from first ... seconds (0 = all)
3             degree of baseline polynomial fit
0.5           discard so many seconds from ends of segment
0            maximum non-straightness (in counts; 0=automatic)
```

The first four numerical parameters must be known before DISPCAL is run. The free period and damping of the seismometer can be obtained from an analysis with CALEX or some other system-identification software. The microvolts per count refer to the calibration of the digital recorder and the millimeters of displacement to the stepwise-motion experiment.

The remaining four numerical parameters help the program to decide which parts of the data record represent motion and which ones rest. They are normally chosen after inspecting a plot of inter-mediate signals.

Straight segments of the deconvolved velocity and displacement traces represent the rest phase while during the motion these traces are curved. The program will first determine a general trend from the first n seconds of the record and remove this trend from the whole record. If this parameter is set to zero, the trend is determined from the whole trace. The program will then deconvolve the trace and remove a higher-order trend from it as specified by the „degree" parameter. Then it will try to distinguish between intervals of motion and rest. For this purpose straight lines are fitted to suitable sections of the velocity trace and depending on the residual these sections are classified as curved or straight. The „non-straightness" is the maximum permitted residual in counts. It is automatically determined in this version when set to zero. After identifying the straight segments (i.e., time intervals without motion) the program discards part of each „straight" segment in order to keep a minimum distance from the transients. The result is stored in a logic (yes-no) signal which is written into the file `dispcal.str`. By inspecting a plot of this signal the user may check whether the straightness parameters were correctly chosen.

In a second step of trend removal only the straight segments of the deconvolved velocity are commonly detrended to the same order as before so that they can be used as a baseline. In a third step, straight lines are fitted to each segment of the baseline, and the trend in between is interpolated. When the trend has finally been piecewise removed, the velocity trace is integrated into displacement. The magnitude of the steps in the displacement trace is measured and by comparison with the known mechanical displacement, the generator constant of the seismometer is calculated for each step.

The program first averages the generator constant over all identified steps. Then it does error statistics and eliminates those steps that contribute most to the variance. The final result does therefore not depend on all steps being correctly identified, and is relatively insensitive to incorrectly chosen parameters.

The following intermediate signals are written into files:

<code>dispcal.dat</code>	A copy of the original (broadband-velocity) data
<code>dispcal.v_1</code>	The inversely filtered and detrended velocity trace.
<code>dispcal.str</code>	The "straightness" signal from which the logic signal is derived.
<code>dispcal.0_1</code>	The logic signal: 0 = rest, 1 = motion
<code>dispcal.v_2</code>	Second version of the velocity trace, detrended for the intervals of rest only.
<code>dispcal.w_2</code>	The residual velocity in the intervals of rest.
<code>dispcal.v_3</code>	Third version of the velocity trace, each interval of rest has been individually detrended.
<code>dispcal.w_3</code>	Residual velocity from <code>v_3</code>
<code>dispcal.int</code>	Integral of <code>v_3</code> . This is the final displacement trace from which the amplitude of the steps is read.

A protocol of the whole analysis is printed on the screen and written into the file `dispcal.out`.

Download

The source code and test data are available by anonymous ftp from:
`ftp.geophys.uni-stuttgart.de/pub/ew/dispcal1`
MS-DOS executables and libraries are found in `.../ew/cutables.dos`