Name	DISPCAL
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This program analyzes a single data file containing the output signal of a seismometer during repeated stepwise displacements. The basic concept is described in the Manual Chapter 6 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 eight 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 **<u>data file</u>** 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 **<u>parameter file</u>** dispcal.par has the following structure:

```
'sts1.abs'       name of data file
'STS1-Z WET'     type and serial number of seismometer
20.15            free period of 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
2.               minimum length of straight segment in seconds
5.               maximum non-straightness (rel. to first segment)
0.5              discard so many seconds from ends of segment
1.               length (sec) of straight segment to be evaluated
```

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 ore 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 six 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 a factor by which the residual in a straight segment is allowed to be larger than in the first straight segment. 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:

dispcal .dat	copy of the original (broadband-velocity) data
dispcal .v_1	inversely filtered and detrended velocity trace
dispcal .str	logic signal: 0 = rest, 1 = motion
dispcal .v_2	second version of the velocity trace, detrended for the intervals of rest only
dispcal .w_2	residual velocity in the intervals of rest
dispcal .v_3	third version of the velocity trace, each interval of rest has been individually detrended
dispcal .w_3	residual velocity from v_3
dispcal . int	integral of v_3; 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. See also the version DISPCAL1 of the same program where some of the control parameters are automatically determined.

Download

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