Name	TILTCAL
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This program analyzes a single data file containing the output signal of a seismometer during repeated stepwise tilt. 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.

TILTCAL reads two input files: tiltcal.par and a data file whose name is specified in tiltcal.par. It generates five 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 tiltcal.par file.

The tiltcal.par file has the following structure:

'xtilt3'   name of data file
'STS2 with lever under foot' Type and Serial No. of Seismometer
120.   free period of the seismometer
0.704   fraction of critical damping
3.96   microvolts per count
6.347   acceleration per tilt step, in mm/s^2 (avg.)
0.   determine trend from first ... seconds (0 = all)
1.   minimum length of straight segment
3.   maximum non-straightness (rel. to first segm.)
0.2   discard so many seconds from ends of segment
0.5   length (in 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 or some other system-identification software. The microvolts per count refer to the calibration of the digital recorder.

The remaining five 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 acceleration represent the rest phase. The program will first determine a general trend from the first n seconds of the record and remove this trend from the whole record. lt will then inversely filter the trace and differentiate it so that the resulting trace represents acceleration. Then it will try to distinguish between intervals of motion and rest. For this purpose it will fit straight lines to suitable sections of the record and determine from the residual whether these sections should be considered as straight. The "non-straightness" is a factor by which the residual is allowed to be larger than in the first

straight segment. After identifying the straight segments (i.e. time intervals without motion) the program will discard certain time intervals at their beginning and end. The result is stored in a logic (yes-no) signal which is written into the file tiltcal.str. By inspecting a plot of this signal the user may check whether the straightness parameters were correctly chosen.

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 following intermediate signals are written into files:

tiltcal .dat	A copy of the original (broadband-velocity) data.
tiltcal .vel	The inversely filtered and detrended velocity trace.
tiltcal .acc	The acceleration trace.
tiltcal .str	The logic signal: 0 = rest, 1 = motion
tiltcal .res	The acceleration trace with the transients (intervals of motion) cut out.

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.

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

Download

The Fortran source code and test data are available by anonymous ftp from:
ftp.geophys.uni-stuttgart.de/pub/ew/tiltcal

MS-DOS executables and libraries are found in .../ew/cutables.dos