

Name	UNICROSP
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This program performs a cross-spectral analysis of two time series. It is intended for the comparison of two seismometers or digitizers but has other applications as well. The program asks for the names of the two input files to be correlated. The first one is considered as the reference so if the two files have different levels of noise, that with lower noise should be the first one. As a third parameter, the program asks for the number of bands in one decade of frequency. Start with 3 to 6 if you have no other preference. If you want bands of one octave, set the parameter to $1/\log(2) = 3.322$; for one-third octave, $3/\log(2) = 9.966$.

The program can be used in two different ways:

1. if the transfer functions of the two systems are equal, then signal and noise amplitudes of both signals can be separately determined. In this case, read `ampl`, `nois1`, `amp2` and `nois2` from the output. (Output is written on the screen and into a file 'crospout'.) Ignore `nois2l` and use the cross-phase 'phase' and the amplitude transfer function 'gain' to check if the systems are really equal. 'coher.' is the coherency between the two traces in the specified band.

If the systems have different but known transfer functions, equalize them by inverse filtration before running UNICROSP.

If you observe a systematic mismatch of amplitude or phase between two systems that are supposed to be equal, you may enter an amplitude factor and a time delay for the second signal and repeat the run. This feature is also useful to measure small delay times between similar systems or between seismometers installed at short distance from each other. The program stops if you enter 0,0. If you don't want to be asked for gain and delay, enter the number of bands (third input parameter) negative.

2. Alternatively, the program can handle the situation that the first system has a known transfer function and is noise-free while the second system is noisy and has an unknown transfer function (as might be the case when testing a poor seismometer against a good one). Then `nois2l` is the noise of the second system (in digital counts) and 'phase' and 'gain' give its transfer function relative to the first system. If the coherency 'coher.' is less than 0.5, then `nois2` might be a better estimate for the noise of the second system than `nois2l`.

In the output, the frequency band is specified by center frequency 'center' and bandwidth 'bwidth' in Hz or mHz, whichever is appropriate. The last line of the output list is the total over all frequencies.

The test data `stu.z`, `stu.n`, `stu.e` contain a surface-wave train; the E component contains the

Rayleigh wave, as you may see from its good correlation with Z at frequencies below 0.1 Hz and from its relative amplitude and phase. When testing seismometers for noise, much longer data sets (several hundred times longer than the longest period of interest) should be used. Also, the narrower frequency bands you use, the longer data sets you need. Uncorrelated noise can produce surprisingly large coherencies when the time series are too short; some tests with synthetic noise may be helpful to appreciate this phenomenon. Suitable test signals may be generated with TESTSIG in the Sinfit directory.

Format of the DATA FILES

The structure of the data files 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.

A double-precision version of UNICROSP is also available under the name DBLCROSP. However, the interactive dialog of that version is still in German. Please consult the single-precision version UNICROSP if you do not understand the German text. Double-precision may be required when low-noise systems such as digitizers are tested. The double-precision version produces an 111-column output that should be printed in 'landscape' orientation.

Download

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

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