UNIVERSITY OF CANTERBURY
Department of Civil Engineering

COMPUTER PROGRAM LIBRARY

Program name:– **SPECTRA**	Program type:– Response Spectrum Analysis	Program code:– ANSI Fortran77
Author:– Athol J Carr		Date:– April 30, 2002

SPECTRA

Response Spectra Computation

Purpose

This program is designed to compute and plot the response spectra for an input earthquake accelerogram. The program computes the Spectral Displacement SD, the Spectral Velocity SV, The Pseudo Spectral Velocity PSV, the Spectral Acceleration SA and the Pseudo Spectral Acceleration PSA. The program also produces an Energy Spectra which is defined as the square root of the integral over the duration of the record of the velocity of the mass multiplied by the ground acceleration. The output is both tabular and graphical. The input formats for the accelerograms are the same as those formats accepted by the program RUAUMOKO.

Method of Analysis

The program asks for information on the range of natural periods, period interval and damping ratios before reading and digitizing the accelerogram. It then, for each damping ratio, computes the responses of single degree of freedom oscillators where the natural period is varied over the period range specified. The program has no user manual as all data is prompted for and there are help files available in the program

Running the post-processor program SPECTRA.

To run the program call the program by the method appropriate to your operating system. On a personal computer just type **SPECTRA** assuming that the files **SPECTRA.EXE** and the associated **.DLL** and **.HLP** files are in your current directory or path.

In Microsoft Windows operating systems another option is to create a shortcut on the desktop and for this purpose a suitable icon for SPECTRA, **Spectra.ico**, is supplied with the program.

The program prompts for responses to a series of questions. Default responses, where appropriate, are enclosed in square brackets, **[ ]**. File names must match the conventions of your operating system but file names, with paths where necessary, must not exceed 60 characters in length and must not contain blanks.

The first question asks for the name of the output file. The default is the computer console or terminal screen

To get hard copies of the plots.

In Microsoft Windows operating systems to get hard copies of the graphs use the pull down 'file' menu and select the Print or Save options to send the graph to the printer or to save the plot as a bitmap file (**.BMP)**.
On unix systems using GKS graphics select the Hard-copy option from the Choice window

Data for SPECTRA

All data for SPECTRA is prompted for by the program using the TinyCLIP command processor. For help on the input data or on the use of the SPECTRA program type **HELP** or **?** At any prompt. To get help on the command processor type **$HELP** at any prompt.

Note: In the following user guide, each line of required data is indicated by a box containing the data items. Below each box is a description of the data items. The data items on each line may be separated by commas or blank spaces. The format for the items are indicated by the letter at the end of each descriptive line with **A** indicating a character string, **I** indicating an integer value and **F** indicating a floating point number. A floating point number may or may not have a decimal point and may also take a scientific or exponent form such as 1.5E6 which could also be expressed as 1500000.0. Character strings will be upper-cased unless enclosed in double or single quotes and will terminate at the first blank space unless the string is enclosed in quotes.

Accelerogram Data

a. Accelerogram flag.

One input line with the word **STAR**, **START** or **DATA:** (the colon is mandatory) starting in column 1 and the word must be in upper case. This **START** line may be preceded by as many header lines as desired. This **START** line is not used for PEER Format records as these records start with 4 lines of header information.

START

b. Accelerogram

The remainder of the input is the acceleration record itself. The record is in the form of a series of lines each of which starts with a *Line Sequence Number* (which must be in an ascending order) followed by either (i) a group of 4 or 1 successive time-acceleration points (BERG, FREE or EXCEL Format), or (ii) a sequence of 10, 8 or 4 uniformly spaced acceleration values at **DELTAT** time intervals apart, the (CALTECH, NCEER, CSMIP or PEER Formats).

Note that the NCEER, CSMIP or PEER records do not have a sequence number. The analysis acceleration record will begin at the first time on or implied by the beginning of the accelerogram line **ISTART** and there must then be sufficient lines remaining to span the analysis time-history length **TIME**.

The record must be on one of the following formats. The program will normally determine the accelerogram format from the extension for the file name. If it is not one of the following extensions then the program will prompt for the user to state the format type. The FORTRAN format is provided in parentheses for each case.

(1) **BERG** FORMAT **(I3, 4(F8.4, F9.6))** (default extension is **.eqb**)

ISEQ T1 G1 T2 G2 T3 G3 T4 G4

ISEG	Line sequence number	**I 3**
Ti	Time of point on accelerogram (seconds)	**F 8.4**
Gi	Acceleration (decimal fraction of gravity)	**F 9.6**

If the line sequence number is greater than 999 it is not read or checked by the program.

(2) **CALTECH** FORMAT **(I4, 6X, 10 I6)** (default extension is **.eqc**)

ISEQ G1 G2 G3 G4 G5 G6 G7 G8 G9 G10

ISEQ	Line sequence number	**I 4**
Gi	Acceleration (multiplied by **ASCALE**) at intervals of **DELTAT**	**I 6**

If the line sequence number is greater than 9999 it is not read or checked by the program.

(3) **NCEER** FORMAT **(10 F8.2)** (default extension is **.eqn**)

G1 G2 G3 G4 G5 G6 G7 G8 G9 G10

Gi	Acceleration (multiplied by **ASCALE**) at intervals of **DELTAT**	**F 8.2**

(4) **FREE** FORMAT **(*)** (default extension is **.eqf**)

ISEQ T1 G1

ISEQ	Line sequence number	**I**
T1	Time of point on accelerogram (seconds)	**F**
G1	Acceleration (decimal fraction of gravity)	**F**

The three items may be placed anywhere on the line and separated by at least one blank column. The lines must be in consecutive order with **ISEQ** starting at 1 and increasing line by line. This format is particularly useful where the excitation record has been generated on a spreadsheet.

(5) **CSMIP** FORMAT **(8 F10.3)** (default extension is **.eqs**)

G1 G2 G3 G4 G5 G6 G7 G8

Gi	Acceleration (multiplied by **ASCALE**) at intervals of **DELTAT**	**F 10.3**

(6) **EXCEL** FORMAT **(*)** (default extension is **.eqe**)

T1 G1

T1	Time of point on accelerogram (seconds)	**F**
G1	Acceleration (decimal fraction of gravity)	**F**

The three items may be placed anywhere on the line and separated by at least one blank column. The lines must be in consecutive order. This format, which is similar to the FREE format except without the sequence numbers is particularly useful where the excitation record has been generated on a spreadsheet.

(6) **PEER** FORMAT **(4 E15.7)** (default extension is **.eqp**)

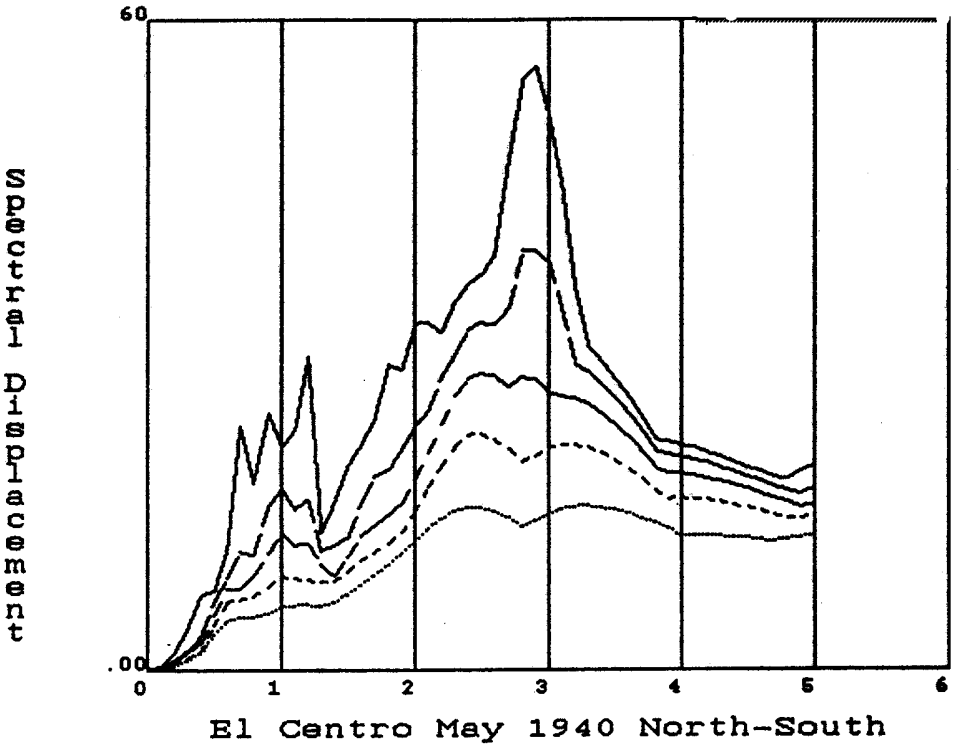
G1 G2 G3 G4

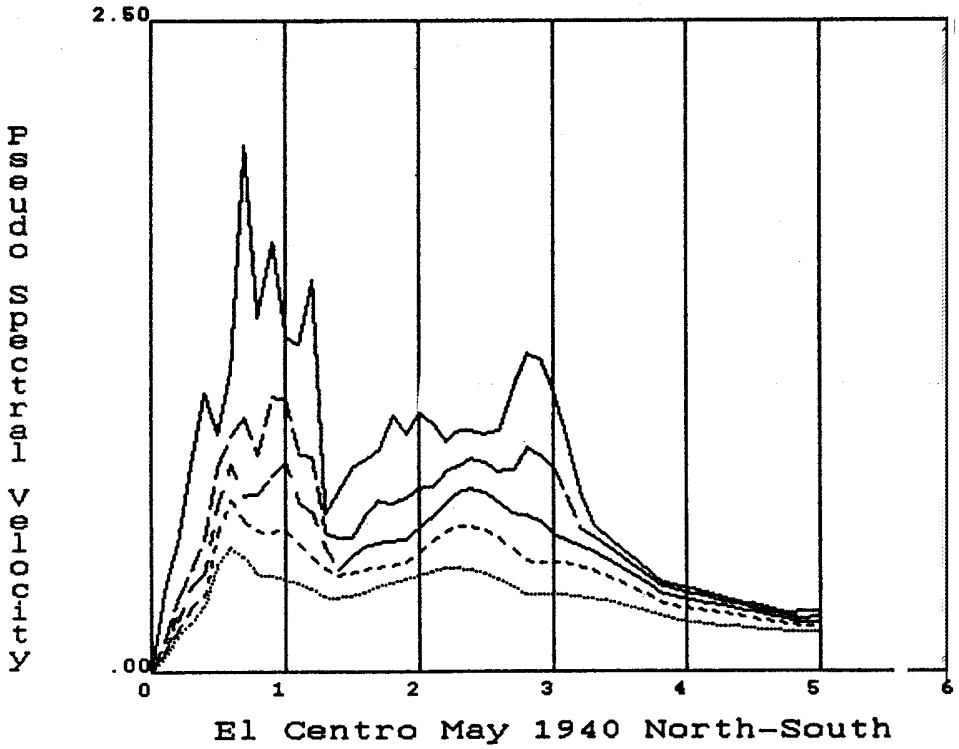
Gi	Acceleration (multiplied by **ASCALE**) at intervals of **DELTAT**	**E 15.7**

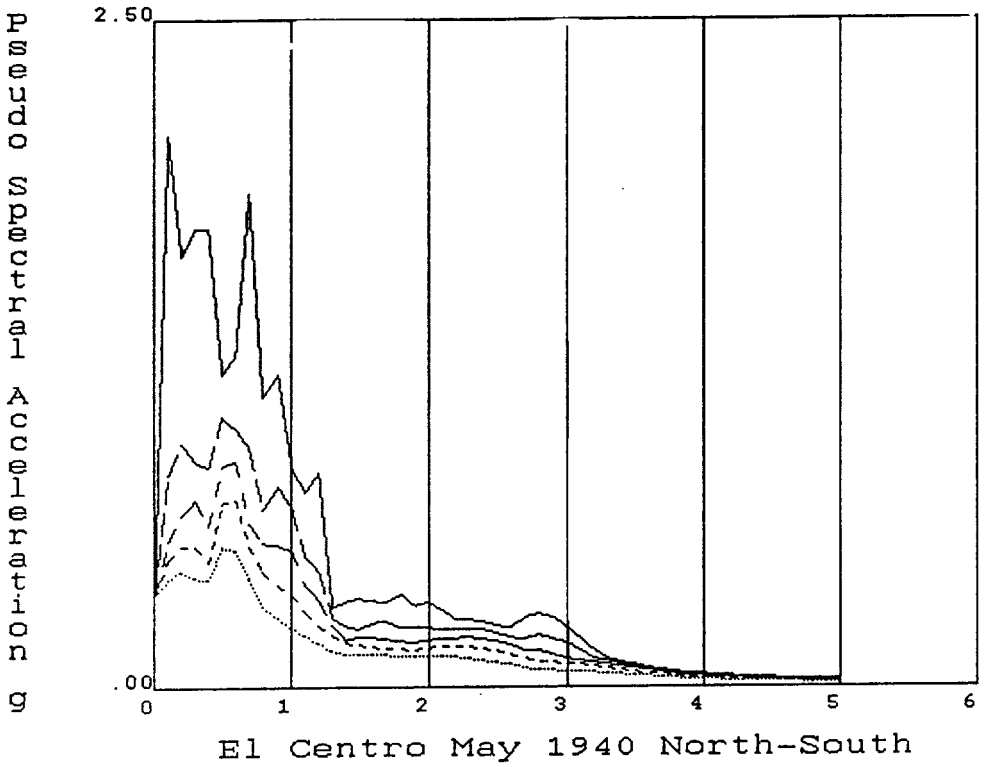
Note: The acclerogram time-step **DELTAT** is usually 0.005 seconds.

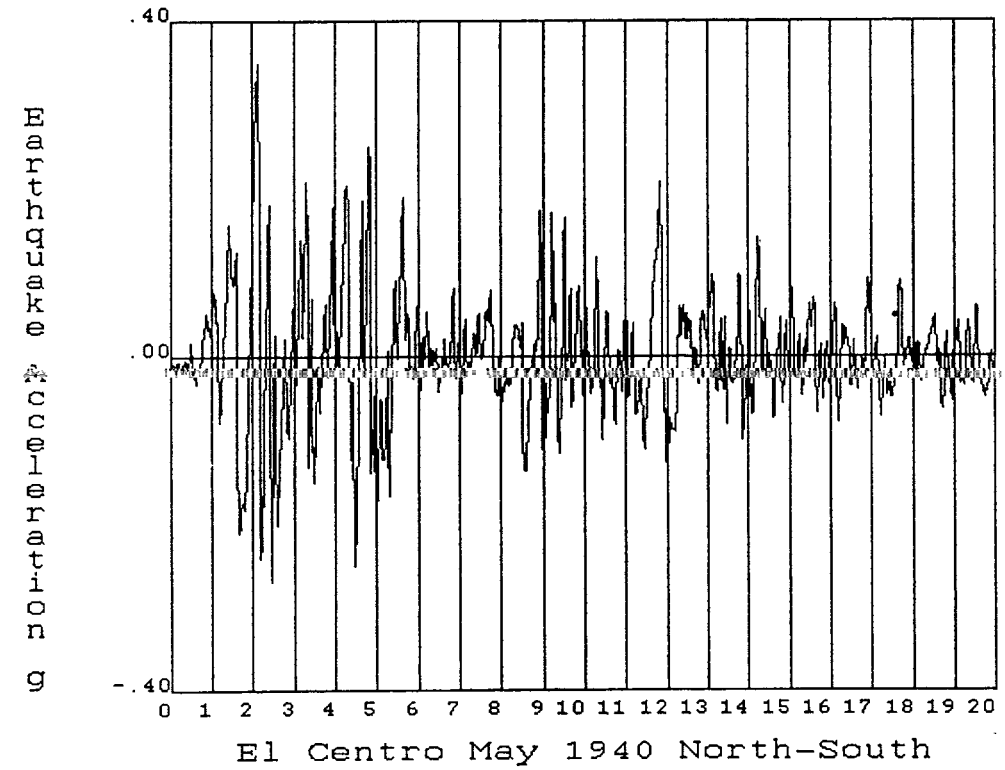
Example

The following pages show the graphic output for the El Centro May 1940 North-South component **EL40NSC.EQB** using the default inputs except for 20 seconds duration and monochromatic plotting.

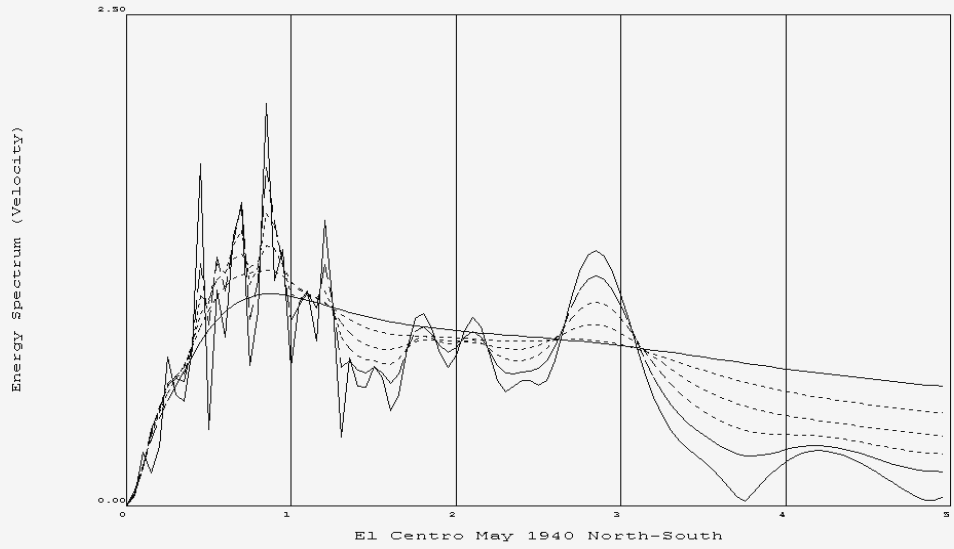





Pseudo Spectral Acceleration g
2.50
.00
0
1
2
3
4
5
6
El Centro May 1940 North-South


Earthquake Acceleration g
.40
.00
-.40
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
El Centro May 1940 North-South

.


2.50
0.00
Energy Spectrum (Velocity)
0
1
2
3
4
5
El Centro May 1940 North-South

End.

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