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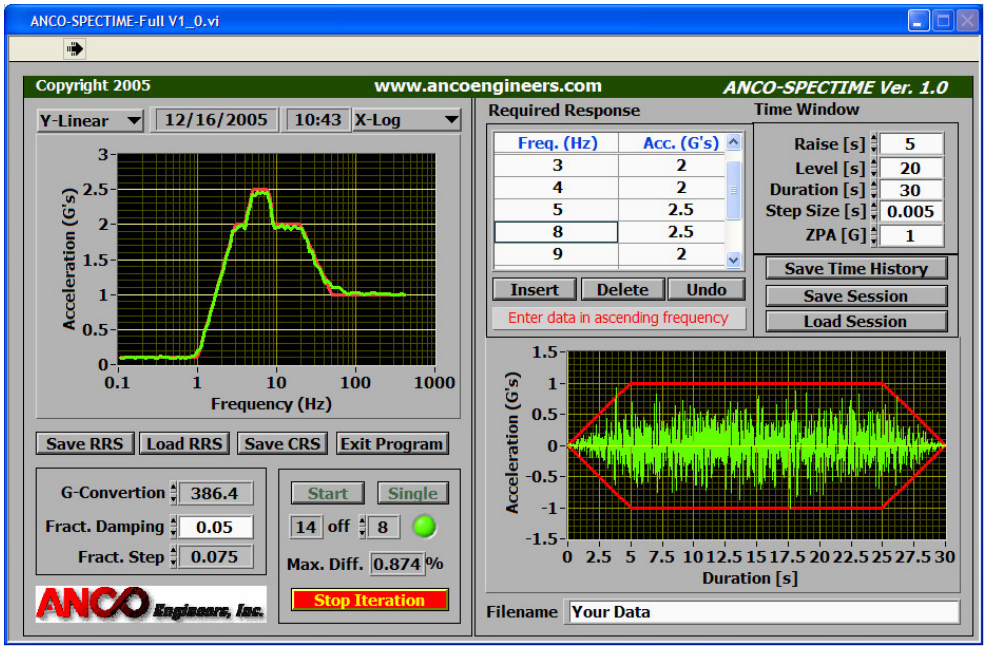
SPECTIME USER'S GUIDE (12/15/2005)

A PROGRAM TO COMPUTE SPECTRUM COMPATIBLE TIME HISTORIES

Seismic shake table users and other seismic researchers often need to develop one or more statistically independent time histories that have a specified response spectrum. The ANCO program SPECTIME produces a text file spectrum compatible time history for use in shake table drivers or analysis programs.

SPECTIME is an executable program using a Virtual Instrument under the National Instruments LabView platform. The host PC does not require the LabView program as all required subroutines are provided in SPECTIME. SPECTIME uses an algorithm similar to that developed by Gasparini and VanMark (MIT 1964). SPECTIME develops the time history as the sum of many sinusoids with different frequencies, phases, and amplitudes. In addition the time history is multiplied by a trapezoidal window to create a tapered response at the beginning and end of the time history. The frequencies are log distributed between 0.1 and 400 Hz. The phases are chosen randomly so as to produce statistically independent time histories each time the program is used. The amplitudes are adjusted iteratively to make the Computed Response Spectrum (CRS) of the time history closely fit the Required Response Spectrum (RRS) specified by the user. The fit typically has an error less than 10%.



LOADING SPECTIME ONTO YOUR PC

The SPECTIME program and all required libraries are contained in a 68 Mbyte directory called SPECTIME that is either downloaded from the ANCO web site or sent to you on a CD. If you have the evaluation version the program you will run is called Spectime-eval.exe. If you have the fully operating version the program is called Spectime-full.exe. The two versions are identical except that the evaluation version can output the synthesized time history.

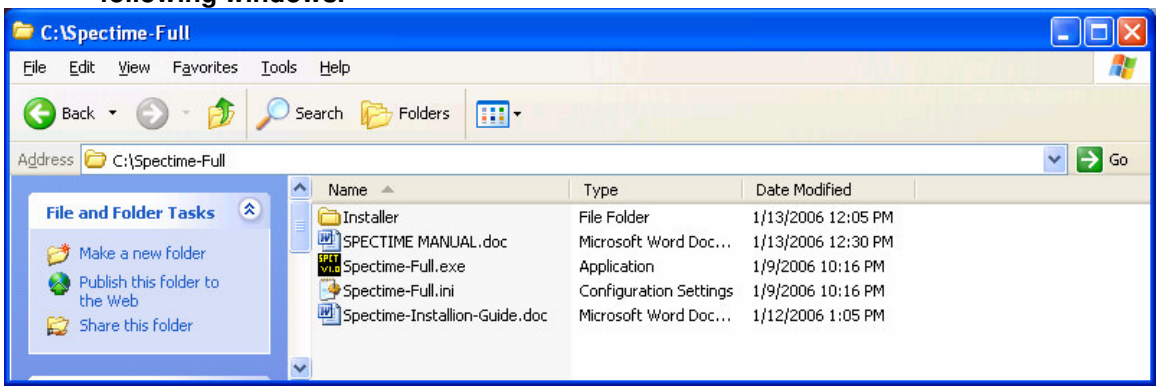
You do not need to have National Instruments LabView installed on your PC.
NOTE: After the installation is complete your PC must be rebooted. It is also recommended to close out all other applications prior to this setup.

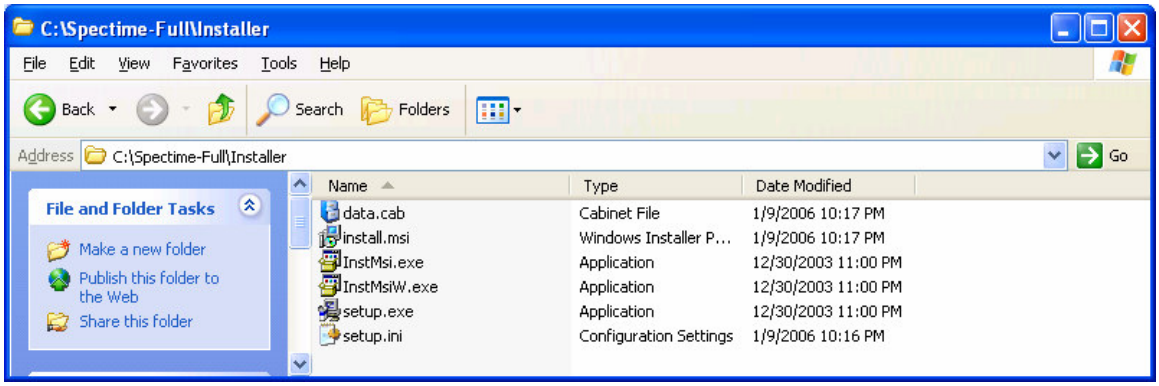
System Requirements for Spectime

1. **Pentium 4**
2. **256MB of RAM (512 MB recommended)**
3. **100MB of Free Disk Space**

Installation Instructions

1. **Insert the CD that ANCO Engineers, Inc. provided you into your computers CD drive then copy the contents of the CD onto your computer.**
2. **Open the folder Installer and run the application startup.exe, as seen in the following windows.**





3. **Follow the onscreen instructions for the setup application. If you need more detailed install instructions there is a file in the download called Spectime Installation Guide with more detailed instruction.**

SPECTIME WINDOW FUNCTION DESCRPTIONS:

1. V-Log/V-Linear: The user may choose to plot the vertical acceleration scale in a linear or logarithmic scale. Both the acceleration plot limits (in G's) and frequency plot limits (in Hz.) can be modified by the user by simply selecting the end points and typing in new limits. The RED curve is the user entered RRS and the GREEN curve is the computed CRS of the time history.

2. Save/Load RRS: The RRS can be saved to a text file (with name *.RRS) or an already saved RRS can be read in. An example format is shown in Figure 1.

3. Save CRS: The computed CRS can be saved in a text file named *.CRS, in the same format as *.RRS.

4. G-conversion: Enter 386.4, the conversion from G to inches/sec^2

5. Frac. Damping: Enter the fraction of critical damping of the RRS (should be between 0 and 1). Do not enter damping in % units!

6. Frac. Step: Enter the fractional frequency step size defining the sinusoidal frequencies. A good number is 0.075. Note that the first frequency is always chosen as 0.1 Hz. The second frequency is at 0.1(1 + Frac. Step), the third is at 0.1(1 + Frac. Step)^2, etc, until 400 Hz is reached. Hence the time synthesis is always from 0.1 to 400 Hz.

7. Start/Single: Select "Start" to start the iteration. Each time the iteration is started a new set of random phases is chosen. The number of iterations is set below this button, up to a maximum of 25. By selecting "Single" the user can add additional iterations, up to a total of 25. Note that this iteration most often but not always converges to a good fit to the RRS. The user can stop the iteration by selecting the Stop Iteration button.

8. Max. Diff.: This filed gives the maximum error between the maximum value of the RRS and CRS.

9. Required Response Spectrum: This table allows the user to enter the RRS (units are Hz. and G). The data must be entered in ascending frequency order (lowest frequency first, then increasing to the highest frequency.) The Insert/Delete/Undo buttons allow for editing this table. As these numbers are modified the RRS plot at the left will immediately be updated.

10. Time Window: This section defines the trapezoidal time window that shapes the resulting time history. The time for the linear rise is Raise (s). The time for the level portion is Level (s). The total duration of the time history is Duration (s). The time step for definition of the time history is Step Size (s). The user must also enter the value of the Zero Period Acceleration or Zero Period Asymptote (ZPA). This value must be equal to the acceleration defining the RRS at the highest frequency.

11. Save Time History: Once the user has created an acceptable time history the user should select this button to output the time history as a text file. The format of this file is single column ASCII with no header line. The data is written as a single column of acceleration data, in G, without time or step size information. The file name will have the *.TH extension. (This button function is disabled in the evaluation version of the program.)

12. Save/Load Session: The user may save the entire screen data set for later loading and additional iterations.

13. Time history plot: The plot to the lower right shows the trapezoidal time history in RED and the iterated time history in GREEN. The time window plot will update immediately when the time window parameters are changed.

14. Exit Program: Select this button to end the program.

15. Filename: This session will be saved under the name indicated in this field with the *.ID extension. This name will also be used for the *.RRS, *.CRS, and *.TH files, unless changed by the user during output selection.

FIGURE 1: *.RRS and *.CRS sample format

Line 1: Title
Line 2: Fractional damping
Line 3: Number of break points in defined RRS
Line 4 on wards: Frequency and acceleration pairs (Hz. and G), tab delimited