SEiSMOAPPS 2018
SEISMO SOFT's SUITE of Earthquake Tools
SeismoApps overview

SeismoSignal, SeismoSpect, SeismoMatch and SeismoArtif constitute a suite of programs that are used to carry out basic earthquake records, such as the processing of strong-motion data, the derivation of elastic & inelastic response spectra and Power & Fourier spectra, the calculation of a number of commonly used ground motion parameters, the adjustment of earthquake records to match a specific target response spectrum, or the generation of artificial earthquake accelerograms.
The structure of the programs follows a very straightforward methodology with a series of input modules (tabs) from the input definition to the results to be extracted. This rational and intuitive approach makes it extremely easy to learn and use; neither manuals, nor tutorial examples or videos are required.

Further, particular emphasis has been put on rendering the programs not only intuitive, but also easy and fast to use. Loading and displaying of the acceleration records or spectral shapes is done in a very efficient way, and the calculations are carried out automatically or with the click of one button. Further, the programs are fully integrated with the Windows environment and the vast majority of output results (e.g. displacement time-history, filtered signal, response spectrum, etc.) are made available to the user in both table and graphical formats.

The tabled data can be copied quickly to any spreadsheet application (e.g. Microsoft Excel), and all the plots can be copied to word processing programs.

All these facilities result in an extremely user-friendly environment, whereby any operation (e.g. strong motion processing, spectral matching or generation of artificial accelerograms) can be done extremely quickly.
SeismoSignal constitutes an easy and efficient way to process strong-motion data, featuring a user-friendly visual interface and being capable of deriving a number of strong-motion parameters often required by engineer seismologists and earthquake engineers.

SeismoSignal opens an accelerogram from text files in different formats.

The main features of the software are as follows:

- Units for both the metric and the imperial system are supported
- Baseline Correction and Filtering
- Velocity & Displacement time-histories
- Fourier and Power spectra
- Elastic and inelastic acceleration, velocity and displacement response spectra
Overdamped elastic spectra

Constant-ductility inelastic spectra

Calculation of several ground motions parameters:

- Peak ground values of acceleration (PGA), velocity (PGV) and displacement (PGD)
- Root-Mean-Square (RMS) of acceleration, velocity and displacement,
- Arias Intensity (Ia)
- Characteristic Intensity (Ic)
- Specific Energy Density (SED)
- Cumulative Absolute Velocity (CAV)
- Acceleration (ASI) and Velocity (VSI) Spectrum Intensity

Four different types of record durations are computed: (i) the Bracketed duration, (ii) the Uniform duration, (iii) the Significant duration and (iv) the Effective duration

Data and results presented in tables or charts and easily exported to other Windows application (e.g. MS Word and MS Excel)
SeismoSpect allows users to open accelerograms from text files in different formats, to create their own library of ground motion records and save them all in a single file making it easy to handle and share large numbers of records.

It features a user-friendly visual interface and is capable of deriving a number of strong-motion parameters often required by engineer seismologists and earthquake engineers.

The main features of the software are as follows:

- Units for both the metric and the imperial system are supported
- Baseline Correction and Filtering
- Velocity & Displacement time-histories
- Elastic and inelastic acceleration, velocity and displacement response spectra
- Overdamped elastic spectra
- Constant-ductility inelastic spectra and simplified inelastic spectra
- Calculation of mean response spectra
- Spectra comparison to reference spectrum
- Calculation of several ground motion parameters:
  - Peak ground values of acceleration (PGA), velocity (PGV) and displacement (PGD)
  - Root-Mean-Square (RMS) of acceleration, velocity and displacement
  - Arias Intensity (Ia)
  - Characteristic Intensity (Ic)
- Specific Energy Density (SED)
- Cumulative Absolute Velocity (CAV)
- Acceleration (ASI) and Velocity (VSI) Spectrum Intensity
- Housner Intensity (HI)
- Sustained Maximum Acceleration (SMA) and Velocity (SMV)
- Effective Design Acceleration (EDA)
- Predominant period
- Number of Effective Cycles
- Damage Index
- Maximum Incremental Velocity (MIV)
- Impulsivity Index (IP Index)
- Average Spectral Acceleration (Sa,avg)

Data and results presented in tables or charts and easily exported to other Windows application (e.g. MS Word and MS Excel).
SeismoMatch is an application capable of adjusting earthquake records, through wavelet addition, to match a specific target response spectrum. Users have the opportunity to simultaneously match a number of accelerograms, and then obtain a mean matched spectrum whose maximum misfit respects a pre-defined tolerance. This software can thus be used in combination with records selection tools and records appropriateness verification algorithms to define adequate suites of records for nonlinear dynamic analysis of new or existing structures.

The main features of the software are as follows:

- Units for both the metric and the imperial system are supported
- For the spectral matching operations, the wavelets algorithms proposed by Abrahamson [1992] and Hancock et al. [2006] and by Al Atik and Abrahamson [2010] are employed
- Baseline Correction and Filtering supported
- Velocity & Displacement time-histories for both original and matched records
- Elastic and inelastic acceleration, velocity and displacement response spectra
- Calculation of mean response spectra
Cumulative Absolute Velocity (CAV)

Acceleration (ASI) and Velocity (VSI) Spectrum Intensity

Housner Intensity (HI)

Sustained Maximum Acceleration (SMA) and Velocity (SMV)

Effective Design Acceleration (EDA)

Predominant period

Significant duration

Data and results presented in tables or charts and easily exported to other Windows application (e.g. MS Word and MS Excel)
SeismoArtif is an application capable of generating artificial earthquake accelerograms matched to a specific target response spectrum using different calculation methods and varied assumptions. It is noted that the use of real accelerograms and spectrum matching techniques (i.e. SeismoMatch), together with records selection tools, tends to be recommended for the derivation of suites of records for use in nonlinear dynamic analysis of structures. However, in those cases where access to real accelerograms is, for whatever reason, challenging or inappropriate, then a tool such as SeismoArtif will be of pertinence and usefulness.

The main features of the software are as follows:

- ✔ Units for both the metric and the imperial system are supported
- ✔ Four calculation methods employed for the generation of accelerograms:
  - **Synthetic Acceleroogram Generation & Adjustment:** Synthetic accelerogram generation [Hallodorson & Papageorgiou, 2005] and correction in frequency domain
  - **Artificial Acceleroogram Generation:** Random set of phase angles with amplitudes calculated by power density function [Gasparini & Vanmarcke, 1976]
- **Artificial Accelerogram Generation & Adjustment:**
  Random process adjustment by correction in frequency domain
- **Real Accelerogram Adjustment:**
  Real accelerogram adjustment by correction in frequency domain

- Large range of envelope shapes available
- Up to eight records generated from one spectrum
- Velocity & Displacement time-histories
- Elastic acceleration, velocity and displacement response spectra
- Calculation of target spectra following the rules from a selection of more than 25 National Building Codes including Eurcode 8, ASCE 41-13 and various Regulations worldwide
- Data and results presented in tables or charts and easily exported to other Windows application (e.g. MS Word and MS Excel).
Seismosoft in brief

Founded in 2002, Seismosoft provides the earthquake engineering community with access to powerful and state-of-the-art tools for structural analysis (SeismoStruct & SeismoBuild), for strong-motion data processing (SeismoSignal & SeismoSpect) and for the derivation of generated and artificial accelerograms (SeismoMatch & SeismoArtif).

With more than 1000 software academic and commercial license requests per month, and users in thousands of international academic/research institutions and practicing companies in more than 110 countries worldwide, Seismosoft is now recognised as a leading enterprise in the development of software tools for structural and earthquake engineering.

Ultimately, by rendering readily available the full spectrum of earthquake engineering tools and methods that feature, not only technical excellence, but also efficiency and user-friendliness, Seismosoft hopes to somehow contribute, even if modestly, to the continuous search for higher mitigation of the risks that earthquakes pose to humankind.