S M A P Version 7.06 Update Note

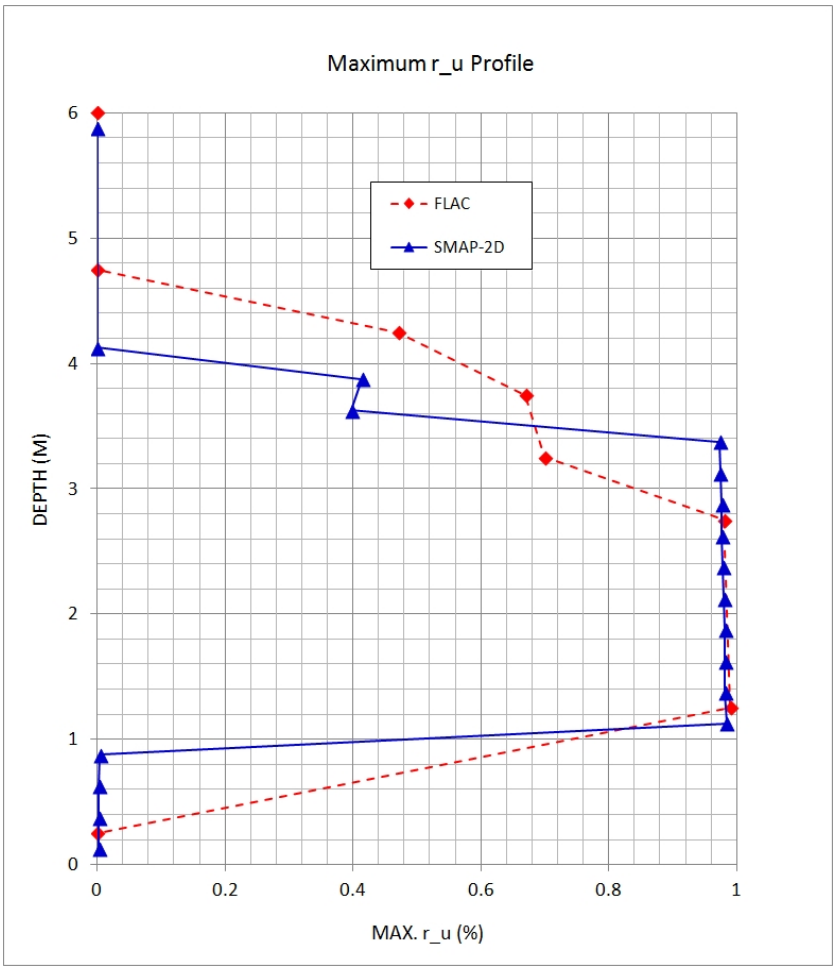
March 1, 2024

SMAP Version 7.06 includes following new features:

1. Liquefaction Analysis with PM4Sand

SMAP-2D and SMAP-3D include Example Problem VP34.
The main objective of this example is to verify PM4Sand model implemented in SMAP-2D /3D under the plane strain condition. The PM4Sand (Boulanger and Ziotopoulou, 2017) is the effective stress material model which is calibrated in finite difference program FLAC 8.0 (Itasca 2016) for the plane strain condition.

Following graph shows liquefied zones in the free field analysis compared with FLAC.
r_u = Excess Pore Pressure / Initial Effective Vertical Stress



2. Response Analysis Menu

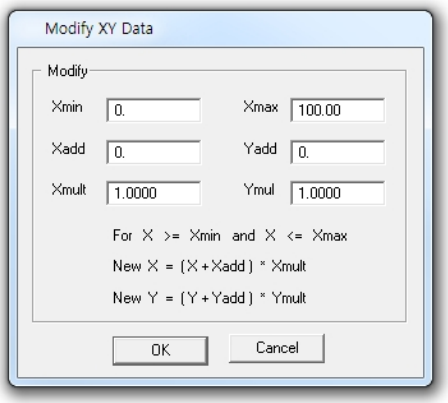
SMAP-2D and SMAP-3D add Cudss and Modxy to Response Analysis Menu:

Convert	Changing format of input earthquake acceleration data
Spectra	Constructing response spectra from acceleration history
Shake 91	Solving 1D seismic response by frequency domain analysis
Srap 1D	Solving 1D seismic response by modal analysis
Quad 4M	Solving 2D seismic response by finite element analysis
Nonsap	Solving static and dynamic response of nonlinear systems
State	Plotting stress state on p-q space and octahedral plane
Cudss	Solving stress-strain response at a single point for PM4Sand
	DM_DSS Drained Monotonic Direct Simple Shear
	DM_PSC Drained Monotonic Plane Strain Compression
	UM_DSS Undrained Monotonic Direct Simple Shear
	DC_DSS Drained Cyclic Direct Simple Shear
	UC_DSS Undrained Cyclic Direct Simple Shear
Modxy	Modifying each XY data curve separately for PLOT-XY

All examples enclosed in the directory C: \ Smap \ Response

3. Modifying Each XY Curve

PLOT-XY includes Modify XY window which allows modification of each curve.



S M A P Version 7.05 Update Note

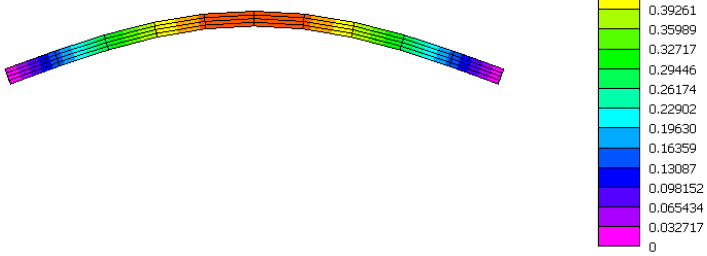
April 1, 2023

SMAP Version 7.05 includes following new features:

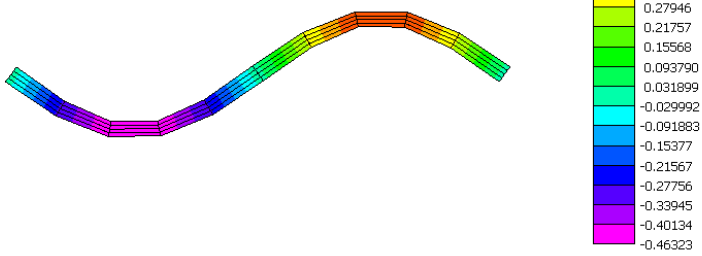
1. Beam Modal Analysis

SMAP-2D includes Example Problem VP31.
This example solves dynamic response of a simply supported beam subjected to a concentrated step load at mid span by Modal Superposition Method.

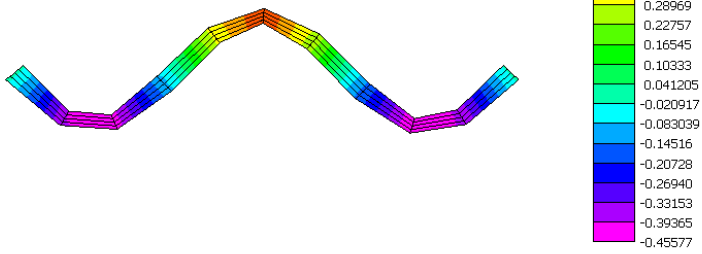
First Mode (w = 1.358 rad/s)



Second Mode (w = 5.369 rad/s)



Third Mode (w = 11.774 rad/s)

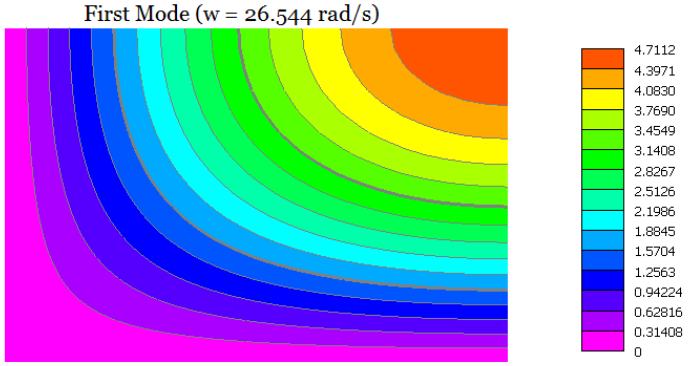


2. Plate Modal Analysis

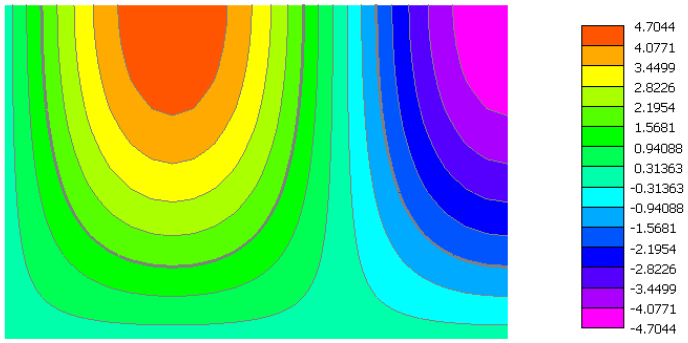
SMAP-3D includes Example Problem VP31.

This example solves dynamic response of a simply supported rectangular plate subjected to a concentrated step load at center by Modal Superposition Method.

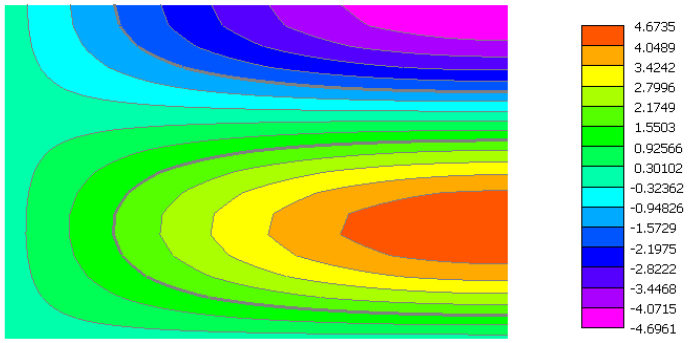
First Mode (w = 26.544 rad/s)



Second Mode (w = 91.729 rad/s)



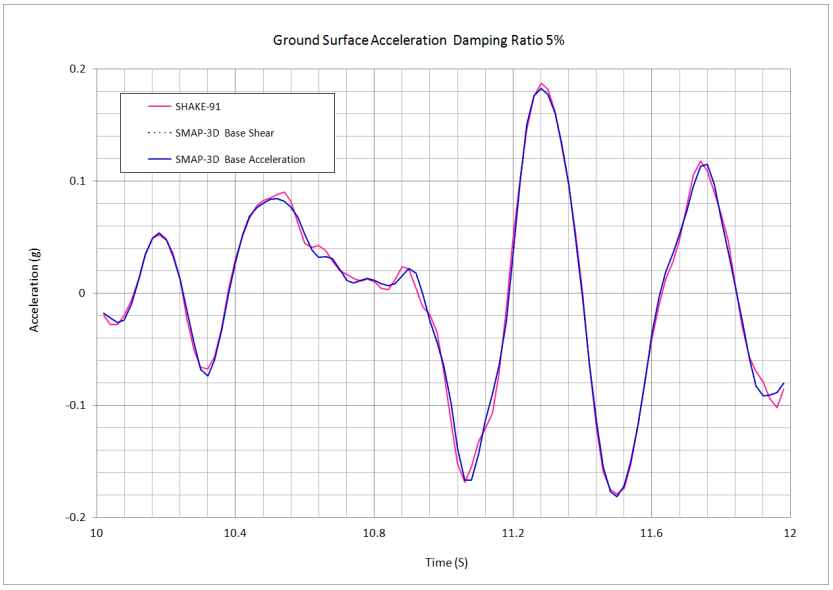
Third Mode (w = 172.992 rad/s)

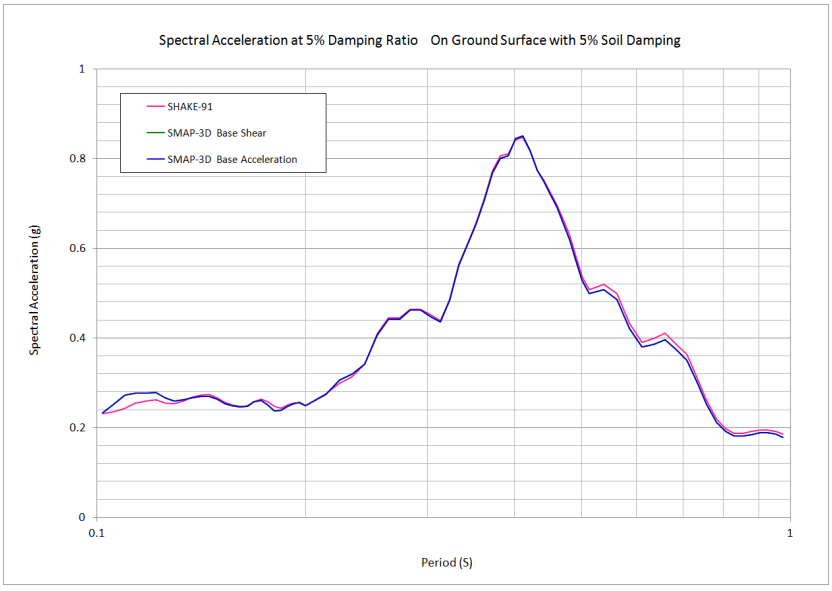


3. Seismic Response Analysis

SMAP-2D and SMAP-3D include Example Problem VP32.

This example solves free-field seismic response of the linearly viscous elastic soil profile subjected to 1989 Diamond Heights earthquake excitation from the bedrock.





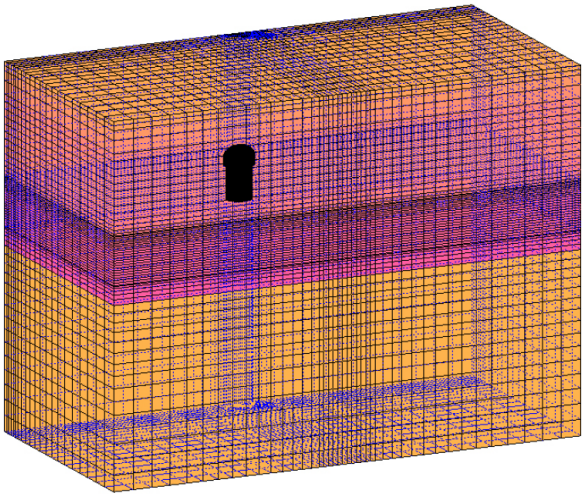
4. Silo Lining Analysis

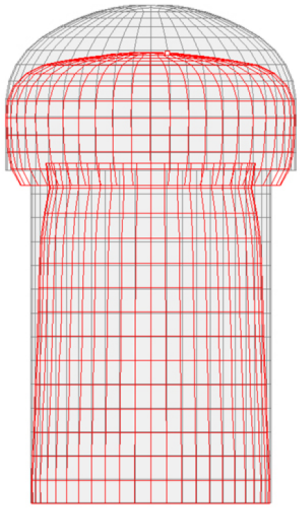
SMAP-S2 includes Example Problem VP17.

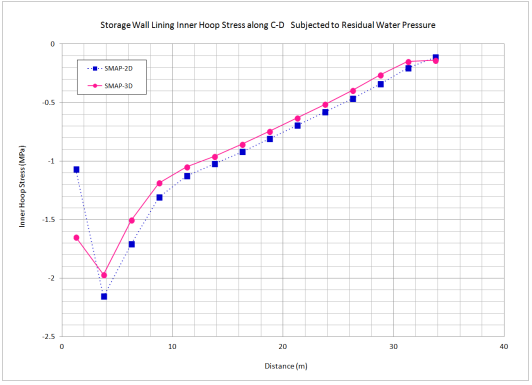
SMAP-2D and SMAP-3D include Example Problem VP33.

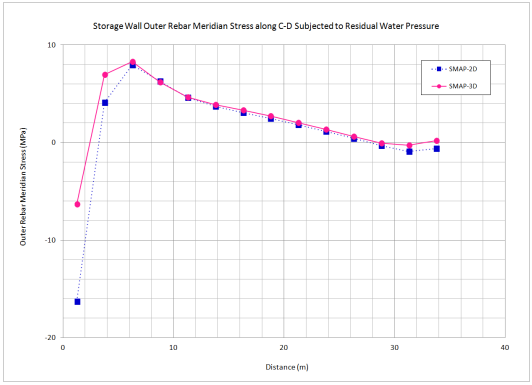
This example solves lining stresses developed in underground silo subjected to residual water pressure. This silo structure in Gyeongju, South Korea, was constructed to store the low-and-intermediate-level radioactive waste.

SMAP-3D model consists of 65,598 continuum, 792 joint, 1,584 shell elements and 71,867 nodes. It takes about 5 hours of run time in the following personal computer: 64 Bit Windows 11, 8 Core i7-11700F CPU, 16 GB of DDR4 Ram.



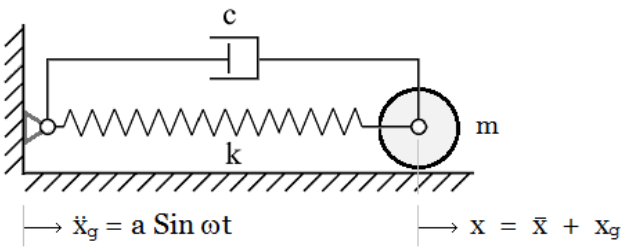


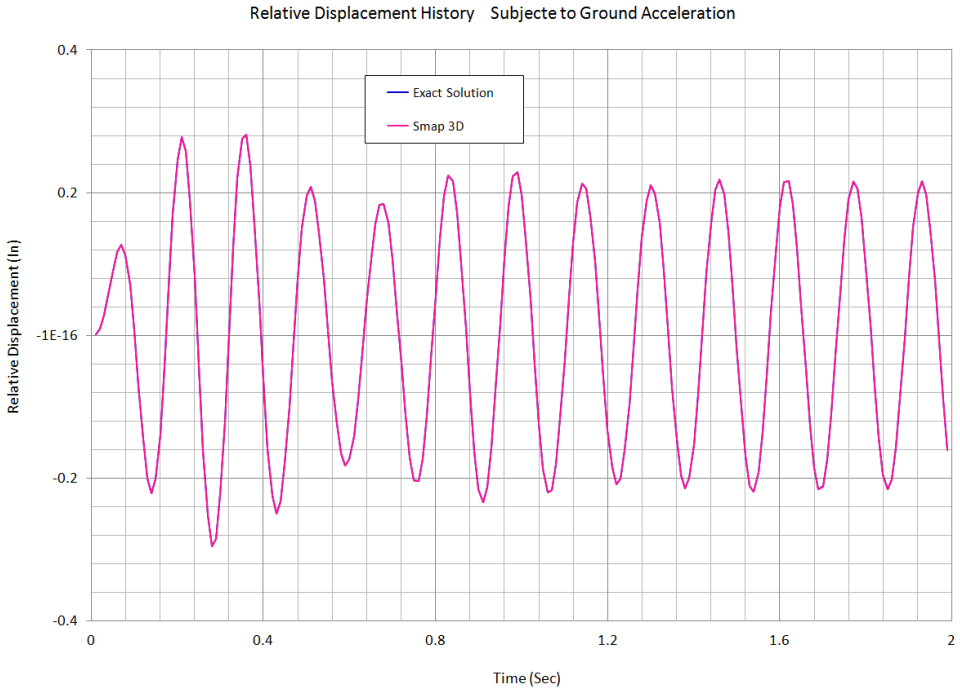




5. SDOF System To Ground Acceleration

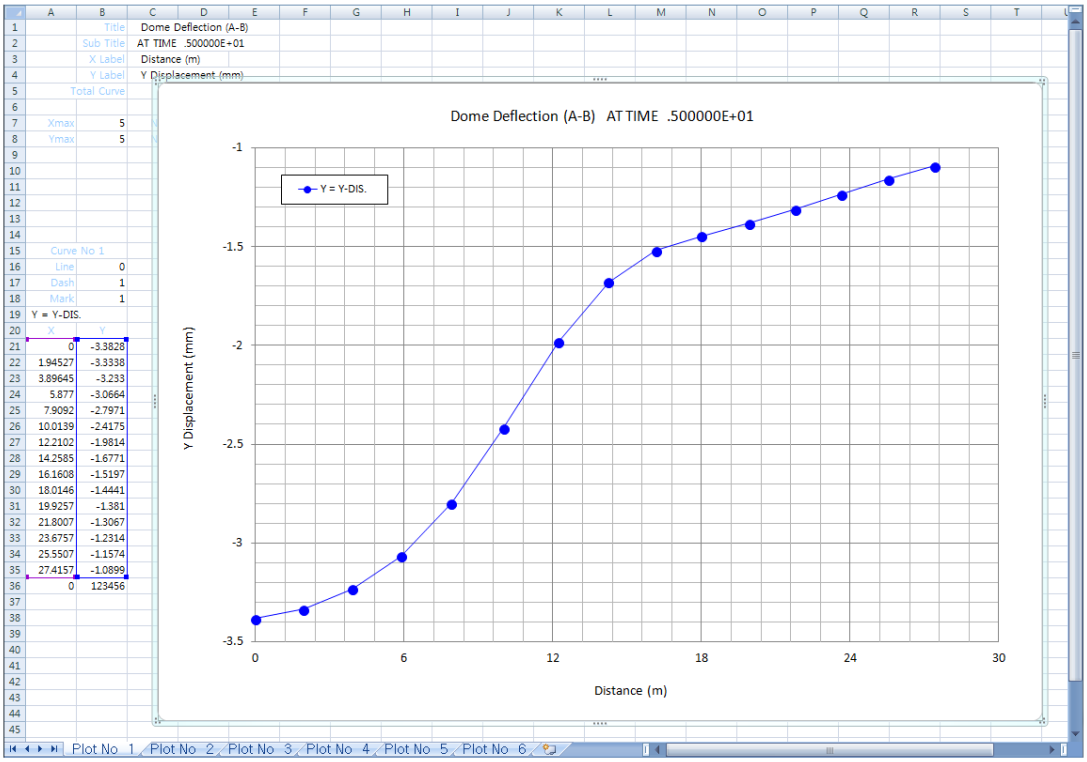
Example problem SMAP-2D (VP28) and SMAP-3D (VP27) now include viscous dampers. SMAP results are almost identical to the exact solutions.





6. Converting PLOT-XY to EXCEL

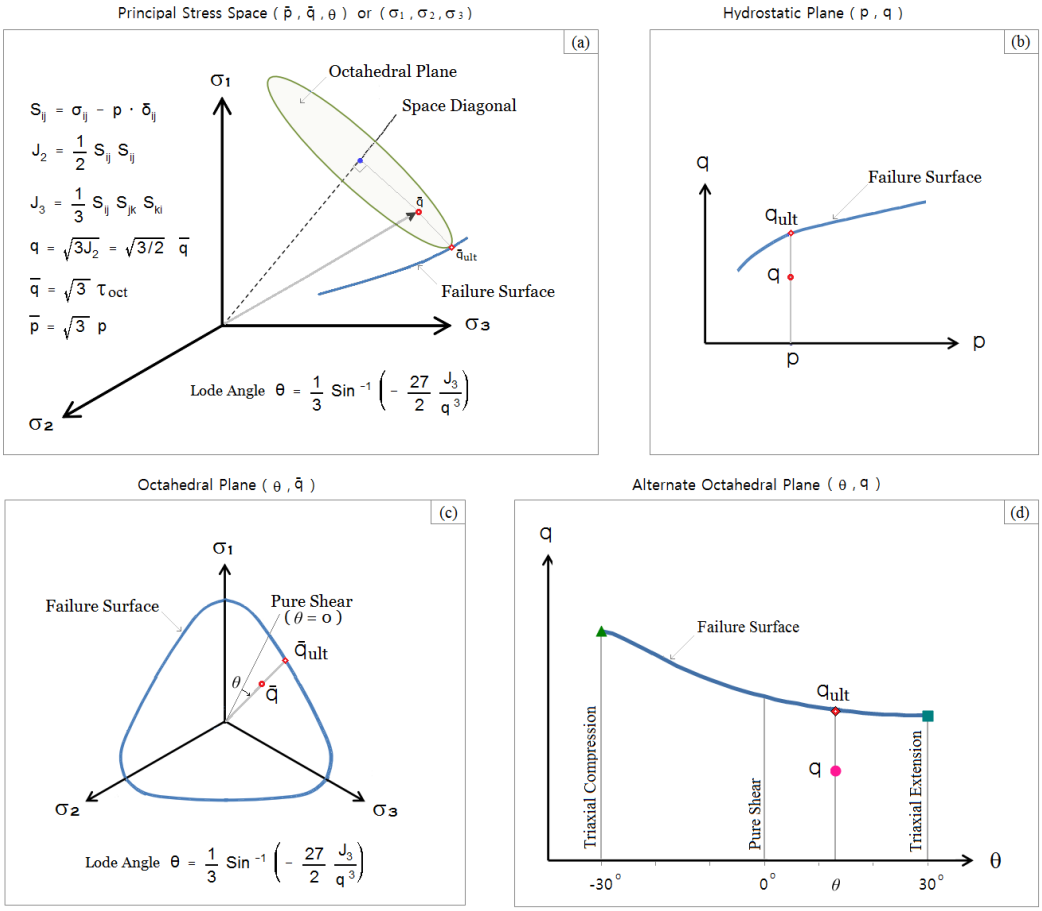
PLOT-XY is the post processing program showing SMAP results in the form of XY graph with file extension .Lin. The guideline illustrates step-by-step procedure for converting PLOT-XY to EXCEL. Refer to (Converting PLOT-XY to EXCEL.pdf) in the directory SmapS2/2D/3D > Example > XY_Graph



When running PLOT-XY, minimum and maximum y values are saved in the directory Current Working Directory \ Temp \ Plot_XY_Min_Max.dat

7. Plotting Stress States

Generally, the stress state at a point can be represented as shown in Figure (a) in the triaxial principal stress space in terms of (σ_1 , σ_2 , σ_3) or ($\bar{p}$, $\bar{q}$, θ). Such three dimensional stress plot can be decoupled to hydrostatic (p , q) in Figure (b) and octahedral plane (θ , $\bar{q}$) in Figure (c), Recently, alternate octahedral plane (θ , q) in Figure (d), which is very simple to use, is proposed in the reference; Numerical Parametric Studies on the Stress Distribution in Rocks around Underground Silo, Feb. 2022, Applied Sciences 12(3) 1613.



SMAP provides stress state plots of both hydrostatic plane (p , q) in Figure (b) and alternate octahedral plane (θ , q) in Figure (d) for the given input stress tensor.

Two examples are given in the directory: c:\Smap\Response\State\

EX-1: STATE_inp.dat, Smap2d > Run > Response Analysis > State

EX-2: EX-2.dat, Smap2d > Run > Smap > Execute

and then Smap2d > Plot > Result > Plot 2d

Refer to c: \ Smap \ Response \ State \ Plotting Stress State.pdf

8. Plotting Response Spectra

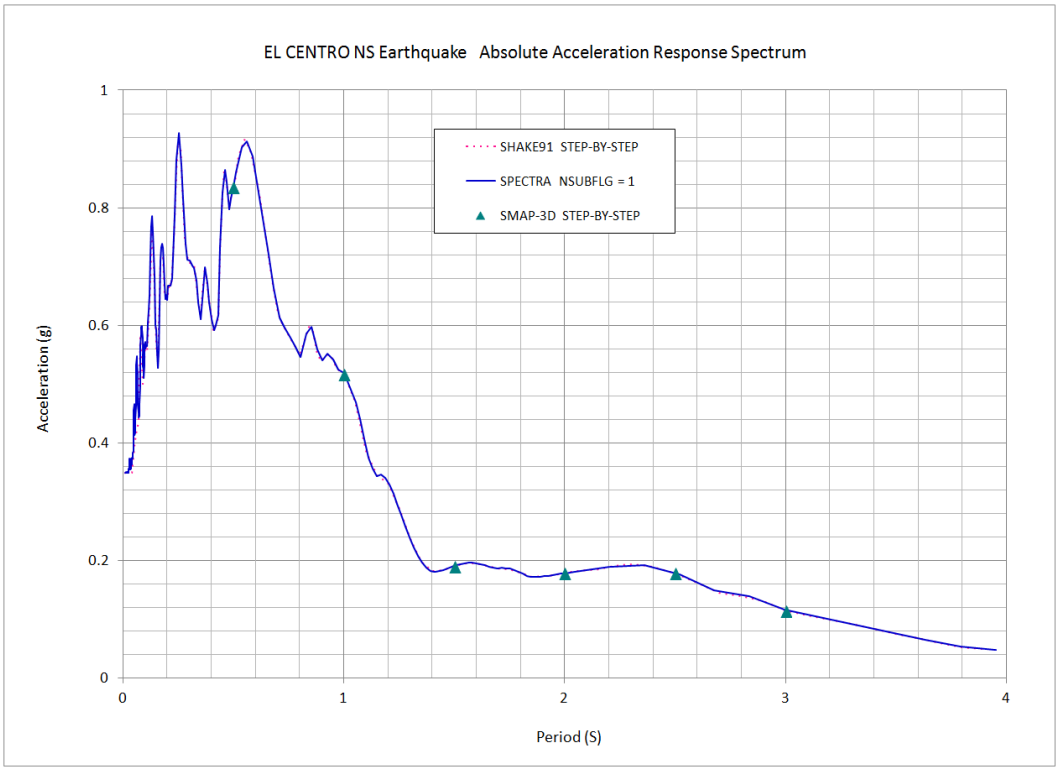
Response spectra are plots of the maximum response of the single degree system over a range of its natural period and selected values of damping for the given ground acceleration time history. Response spectra provide characteristics of the ground motion and its effects on the single degree of freedom structure.

SPECTRA is the modified version of program originally written by D. B. McCallen in 1991, Lawrence National Laboratory, University of California, Livermore, for response spectra generation.

SPECTRA computes following response spectra for the given acceleration time history.

- Accel_Vs_Freq.Lin Absolute acceleration as a function of frequency (cps)
- Acc_Spectra.Lin Absolute acceleration as a function of period (sec)
- Vel_Spectra.Lin Relative velocity as a function of period (sec)
- Disp_Spectra.Lin Relative displacement as a function of period (sec)

Refer to c: \ Smap \ Response \ Spectra \ Plotting Response Spectra.pdf



9. Response Analysis Menu

SMAP-2D and SMAP-3D include following programs for seismic analyses:

Convert	Changing format of input earthquake acceleration data
Spectra	Constructing response spectra from acceleration history
Shake 91	Solving 1D seismic response by frequency domain analysis
Srap 1D	Solving 1D seismic response by finite element analysis
Quad 4M	Solving 2D seismic response by finite element analysis
Nonsap	Solving static and dynamic response of nonlinear systems
State	Plotting stress state on p-q space and octahedral plane
	All examples enclosed in the directory C: \ Smap \ Response

S M A P Version 7.04 Update Note

April 1, 2021

SMAP Version 7.04 includes following new features:

1. Material Based Element Index Order Change

   Element index orders can be modified using preprocessing program
   ADDRGN based on Material Numbers.
   Refer to Users Manual page 8-18 for ADDRGN-2D and 8-31 for ADDRGN-3D .
   Example problem is included in the folder: ADD-2D/ADD-3D > Others > MOD-6

2. Shell Element Bottom Surface Color and Local X Axis

   Shell element bottom surface can be shown as light yellow by following selections:
   PLOT-3D > Plot > Mesh > Mesh Type > Visible Surface with Material Color
   To see local axis, check Show Shell Local X Axis
   Axis color and line type can be selected by following selections:
   View > General > Shell Local X Axis on Element Top Surface > Select color
   View > Displacement > Display Options > Line Type > Select Solid / Dash

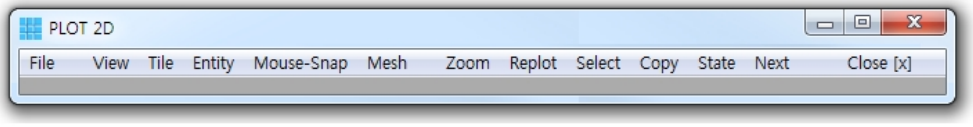
3. Element Activity Data Generation

   (NEL1, -NEL2) in SMAP-S2/2D/3D Users Manual Card Group 8.2 generates
   the same activity from NEL1+1 to NEL2. It also applies to material based activity.
   Refer to Activity.pdf in Example > Smap > Activity

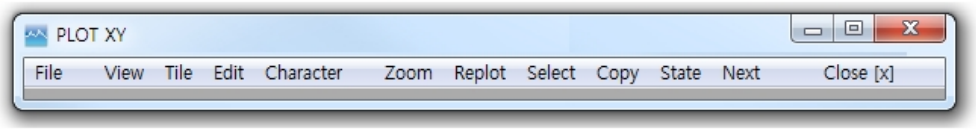
4. Element Surface Traction Generation

   Element surface traction can be generated based on both material and element numbers.
   (NEL1, -NEL2) generates the same surface traction from NEL1+1 to NEL2.
   It also applies to material based surface traction.
   Refer to Users Manual Card 5.7 for SMAP-2D/3D and Card 5.7 for SMAP-S2.
   Refer to Element_Load.pdf in Example > Smap > Load

5. PLOT-2D includes new Express Style menus which are rearranged so as to quickly access most frequently used menu items in practice.
   For Express Style, specify 0 in C:\Smap\Ct\Ctdata\MenuStyle_2D.dat



6. PLOT-XY includes new Express Style menus which are rearranged so as to quickly access most frequently used menu items in practice.
For Express Style, specify 0 in C:\Smap\Ct\Ctdata\MenuStyle_XY.dat



7. SMAP-T2 / T3 includes new verification example VP5 which is an infinitely long plate subjected to sudden application of constant internal heat generating source.

8. LOAD-2D / 3D includes new loading surface generation features based on Node and Element Groups. Refer to SMAP-T2 / T3 load example EX5.

S M A P Version 7.03 Update Note

May 1, 2020

SMAP Version 7.03 includes following new features:

1. Two-way Reinforced Concrete Shell Element
   SMAP-3D: Example Problem VP30

2. Two-way Reinforced Axisymmetric Shell Element
   SMAP-S2: Example Problem VP16
   SMAP-2D: Example Problem VP30

3. Load Vector Plot by PLOT-3D
   SMAP-S2: LOAD-2D\1. Pressure\Running LOAD-2D.pdf
   SMAP-2D: LOAD-2D\1. Pressure\Running LOAD-2D.pdf
   SMAP-3D: LOAD-3D\1. Pressure\Running LOAD-3D.pdf

4. New Feature in Wedge Block Mesh Generation
   PRESMAP-GP: Example Problem EX11

5. Data Value Option on Contour Plot
   PLOT-3D: Select View > General > Data Values

6. Axial, Shear and Rotational Joint Spring Element (*)
   SMAP-S2: Example Problem VP15
   SMAP-2D: Example Problem VP29
   SMAP-3D: Example Problem VP28

7. Soil and Joint Spring Generation for Shield Tunnel (*)
   NATM-2D: Example Problem MODEL2-1
   TUNAPLUS: Users Manual Card Group 6.5 and 6.6

(*) Updated in Version 7.02

SMAP Version 7.00 Update Note

April 25, 2019

SMAP Version 7.0 integrates all SMAP programs in unified and consistent way along with complete users manual. Trial Versions can be used for 30 days without registration.

SMAP Version 7.0 includes following new features:

1. 64 Bit Operating System
   SMAP Solvers supporting Windows 64 Bit Operating System

2. Block Mesh Generator
   3D CAD program specially designed to generate finite element meshes

3. PlotXY Generator
   Graphical User Interface to generate or edit Time Histories of results

4. SMAP-T3
   3D Heat Conduction finite element program with phase change