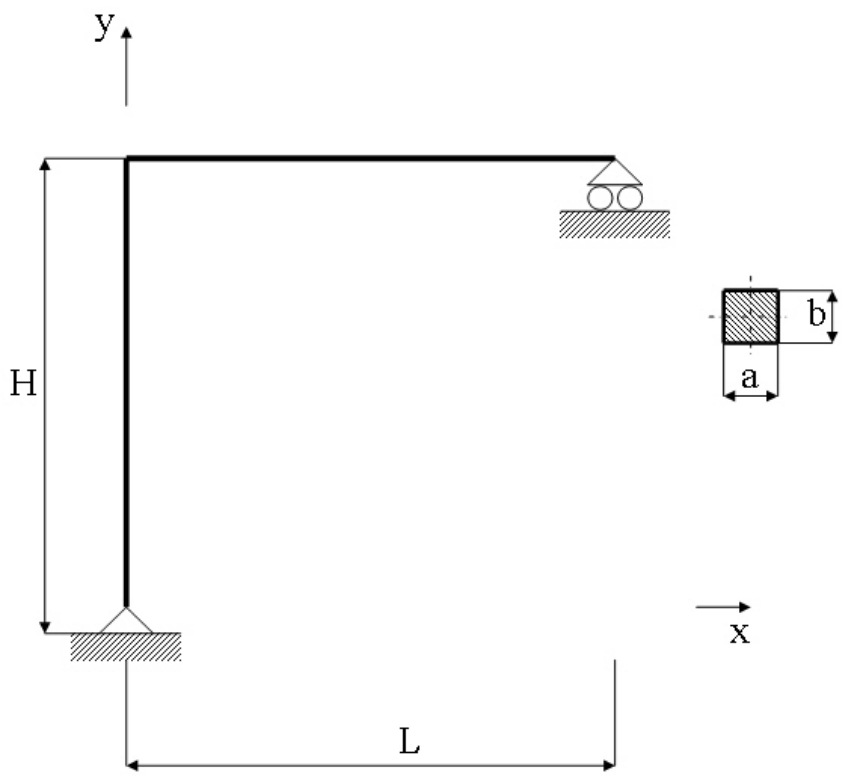
Course in ANSYS

Example0410

Example – Frame 2D



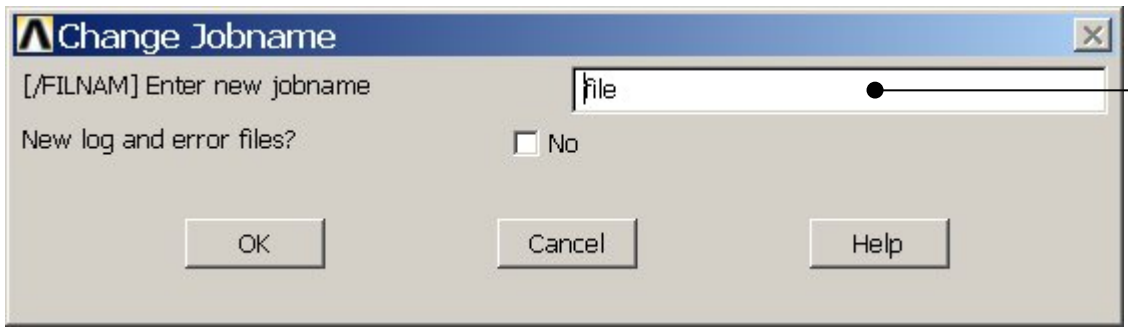
Objective:
Compute the harmonic response
Tasks:
Perform a modal analysis
Display the mode shapes
Perform a harmonic analysis
Topics:
Topics: Start of analysis, Element type, Real constants, Material, modeling, element size for beam models, modal and harmonic analysis

$E = 200E9 N/m^2$
$\nu = 0.3$
$L = 2m$
$H = 3m$
$I = 0.1^4/12 m^4$
$\rho = 7860 kg/m^3$

Example - title

Utility Menu > File > Change Jobname — GUI

/jobname, Example0410 — Command line entry

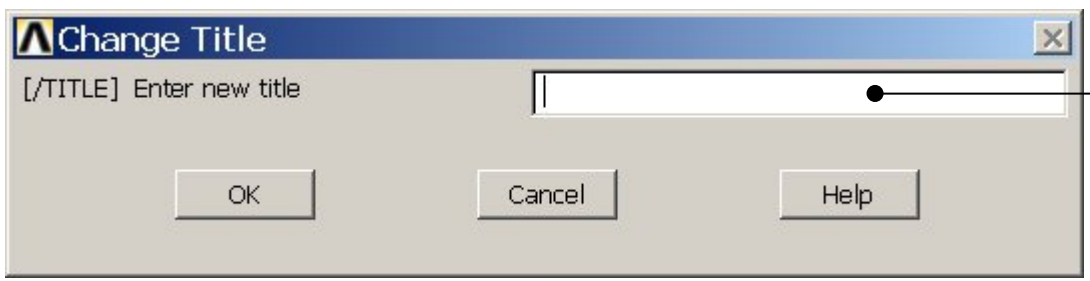


Enter: Example0410

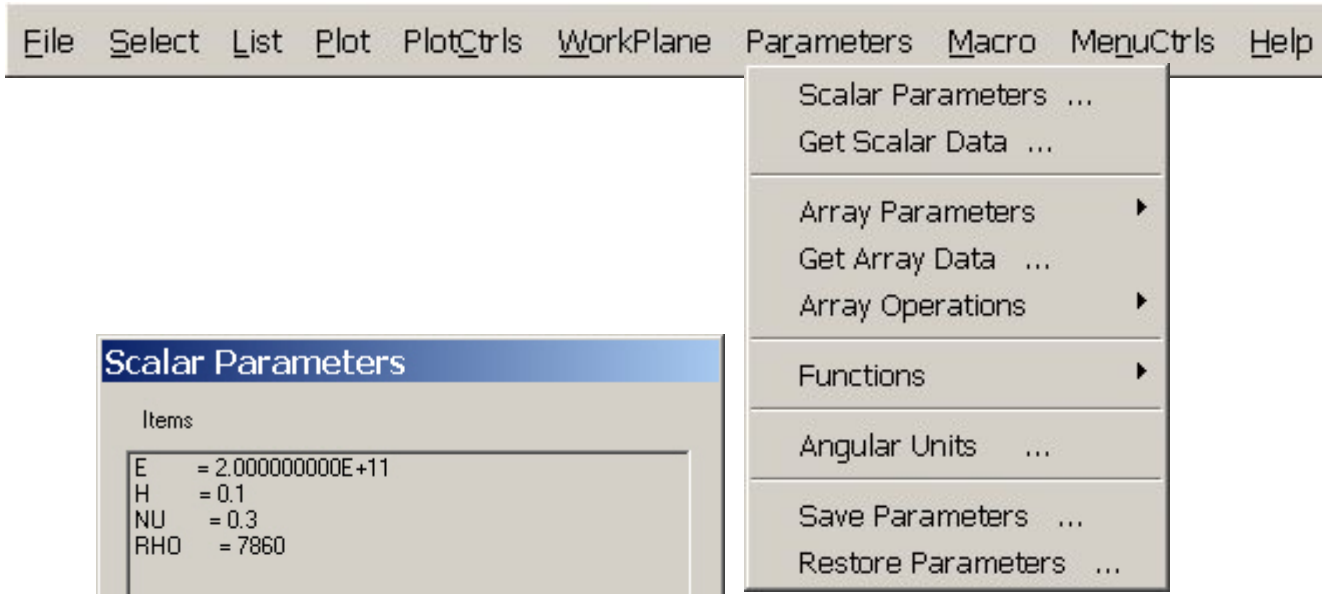
Utility Menu > File > Change Title

/title, Frame 2D

Enter: Frame 2D



Example - Parameters



Example - Keypoints

Note: An empty # result in automatic numbering.

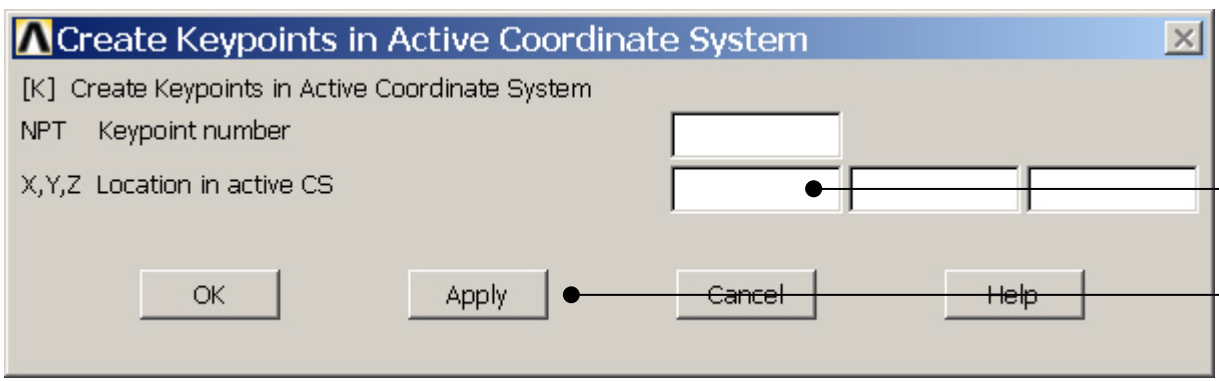
Preprocessor > Modeling > Create > Keypoints > In Active CS

/PREP7
K,,,,
K,,,3,
K,,2,3,

General format:
K,#,X,Y,Z

Keypoint number
X Keypoint x-coordinate
Y Keypoint y-coordinate
Z Keypoint z-coordinate

Enter 0,0,0 and
Press **Apply**
Enter 0,3,0 and
Press **Apply**
Enter 2,3,0 and
Press **Apply**

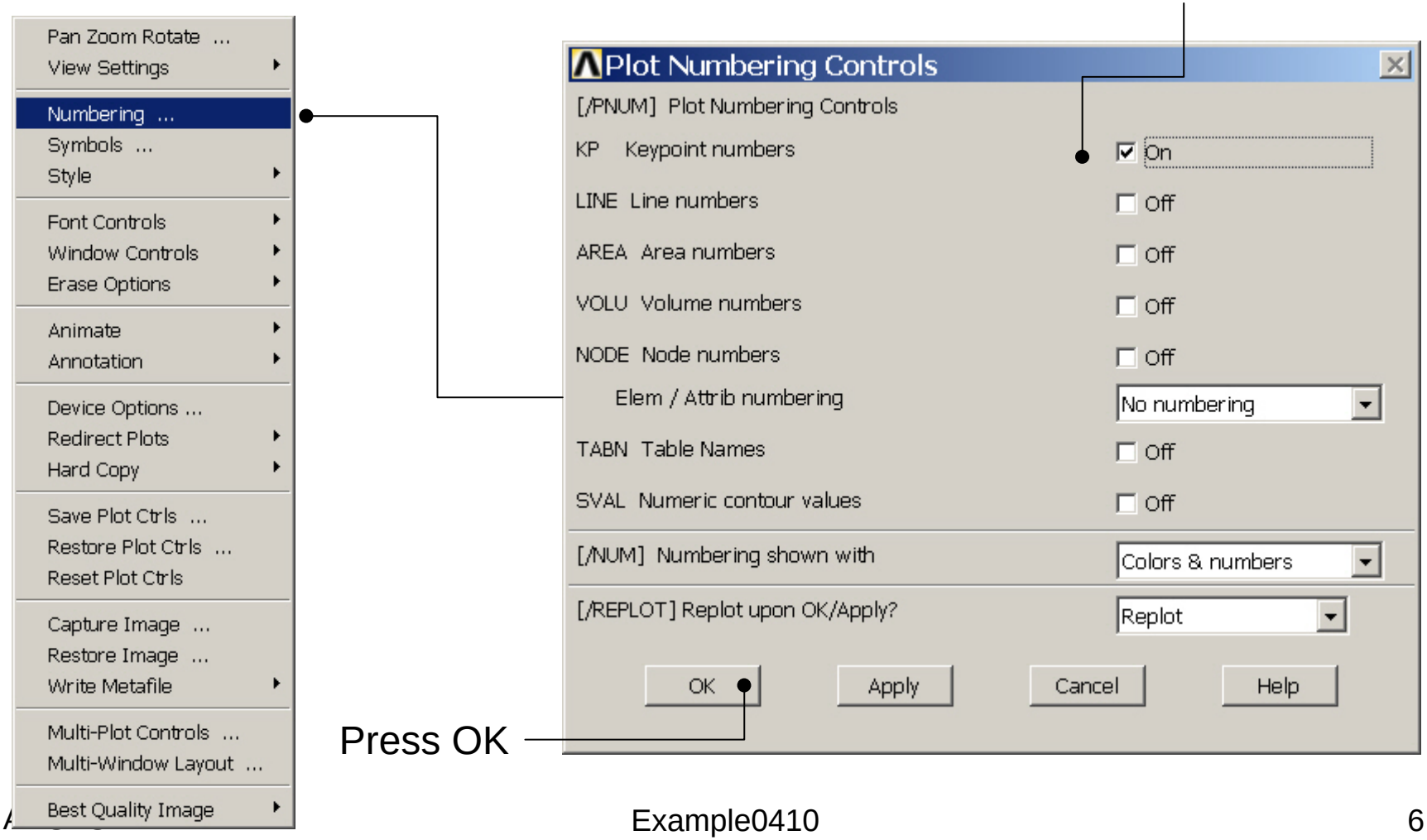


Note: An empty box result in a zero. It is allowed to enter 0.0 in each box.

Example - Numbering

Utility Menu > PlotCtrls > Numbering

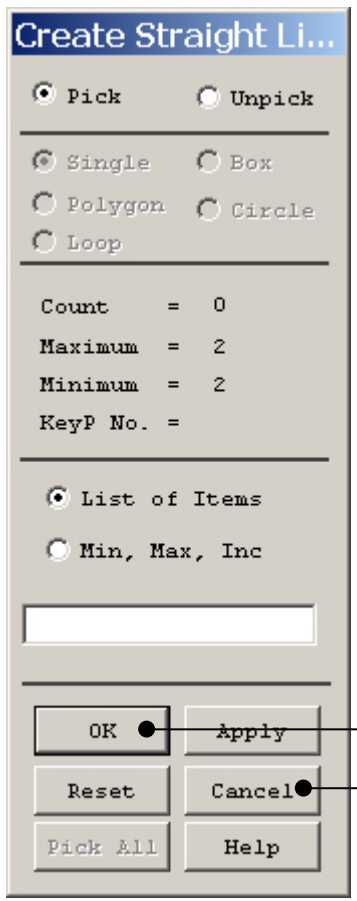
Switch on Keypoint numbers



Press OK

Example - Lines

Preprocessor > Modeling > Create > Lines > Lines > Straight Line
Create a line between KP1 and KP2 and KP2 and KP3.
L,1,2
L,2,3



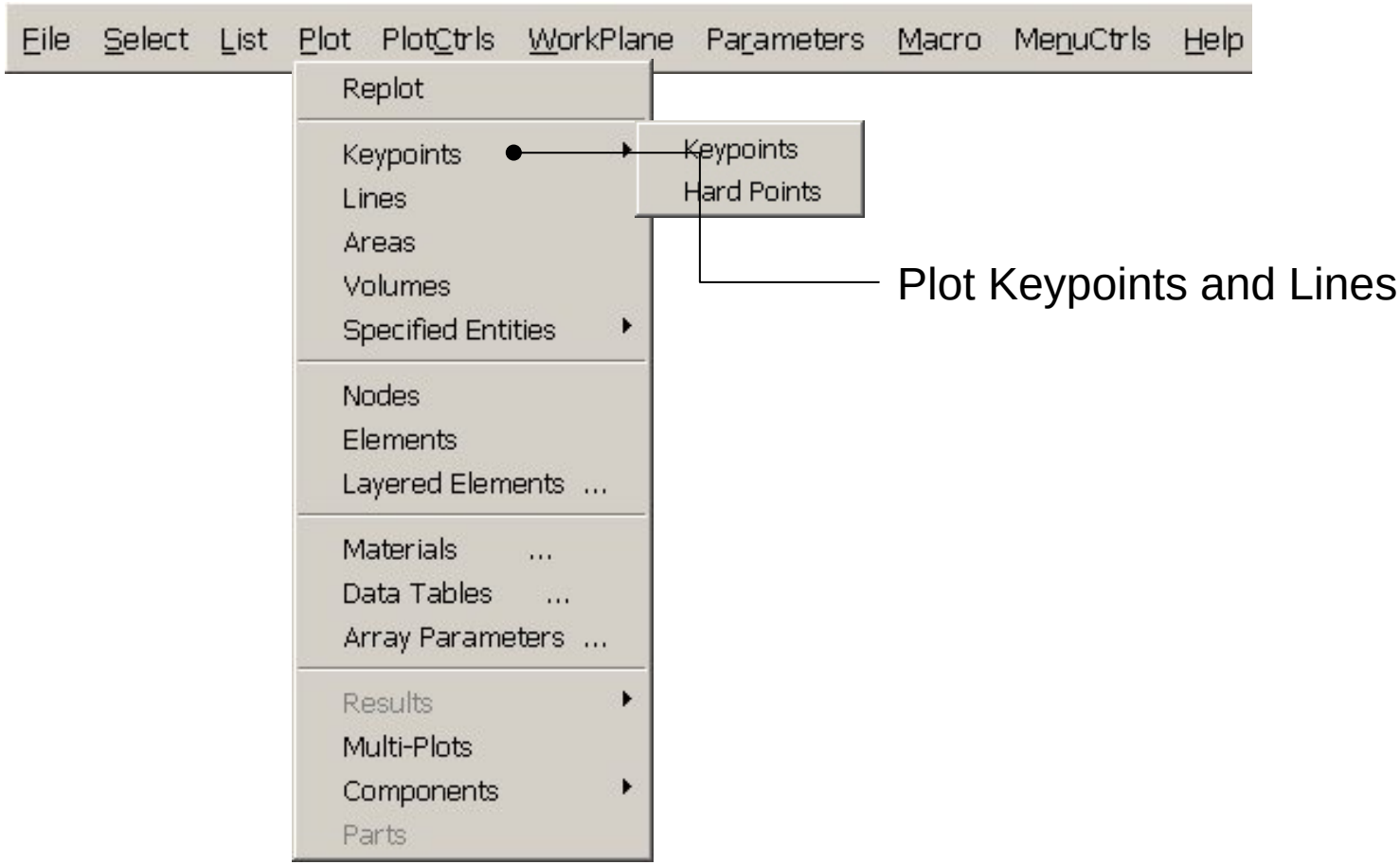
HINT: By clicking with the right-hand mouse button you shift between the Pick/Unpick function. This is indicated by the direction of the cursor arrow:

Pick: upward arrow

Unpick: downward arrow

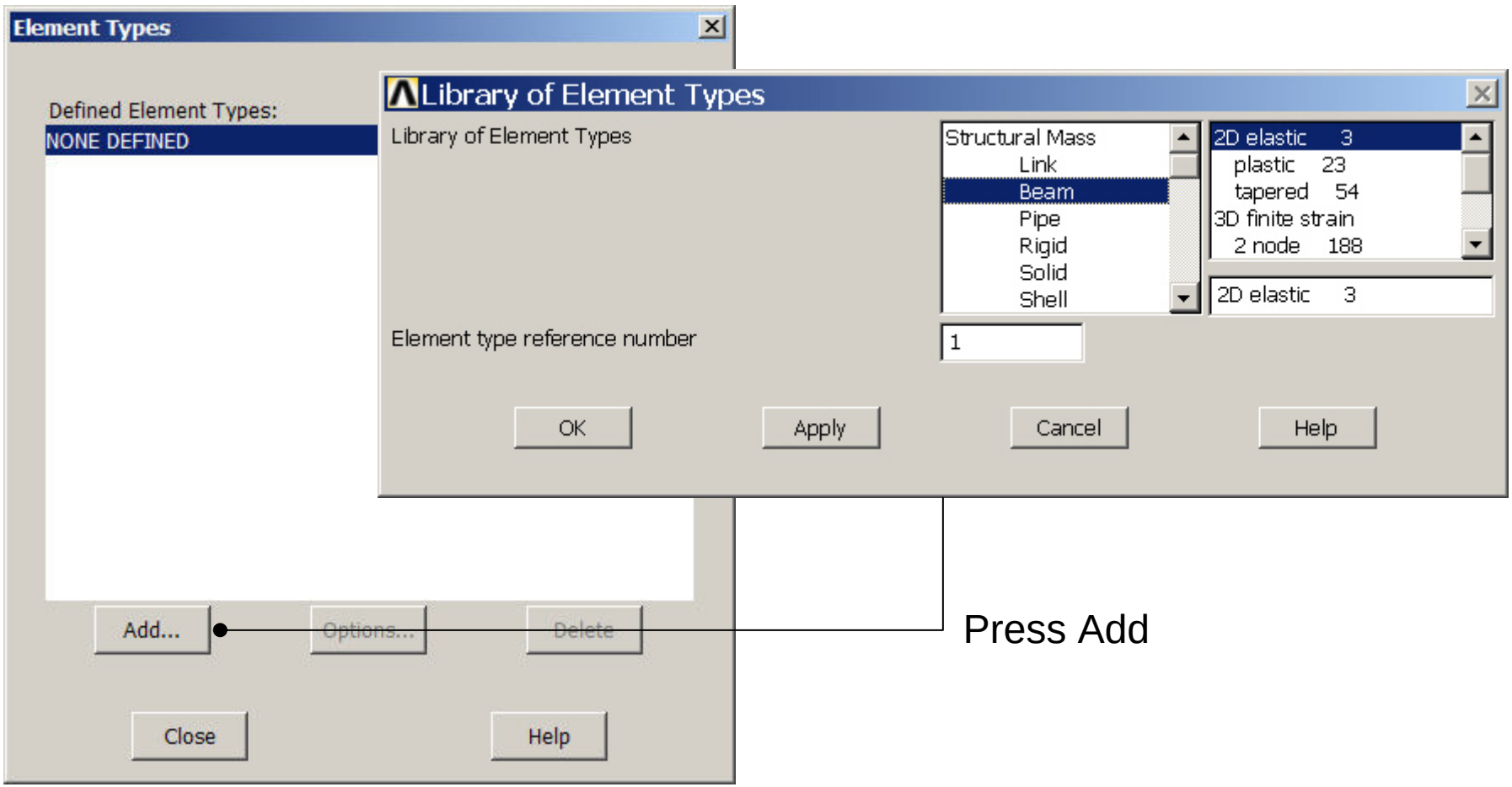
Press OK or Cancel to finish selection

Example - Plot - Nodes



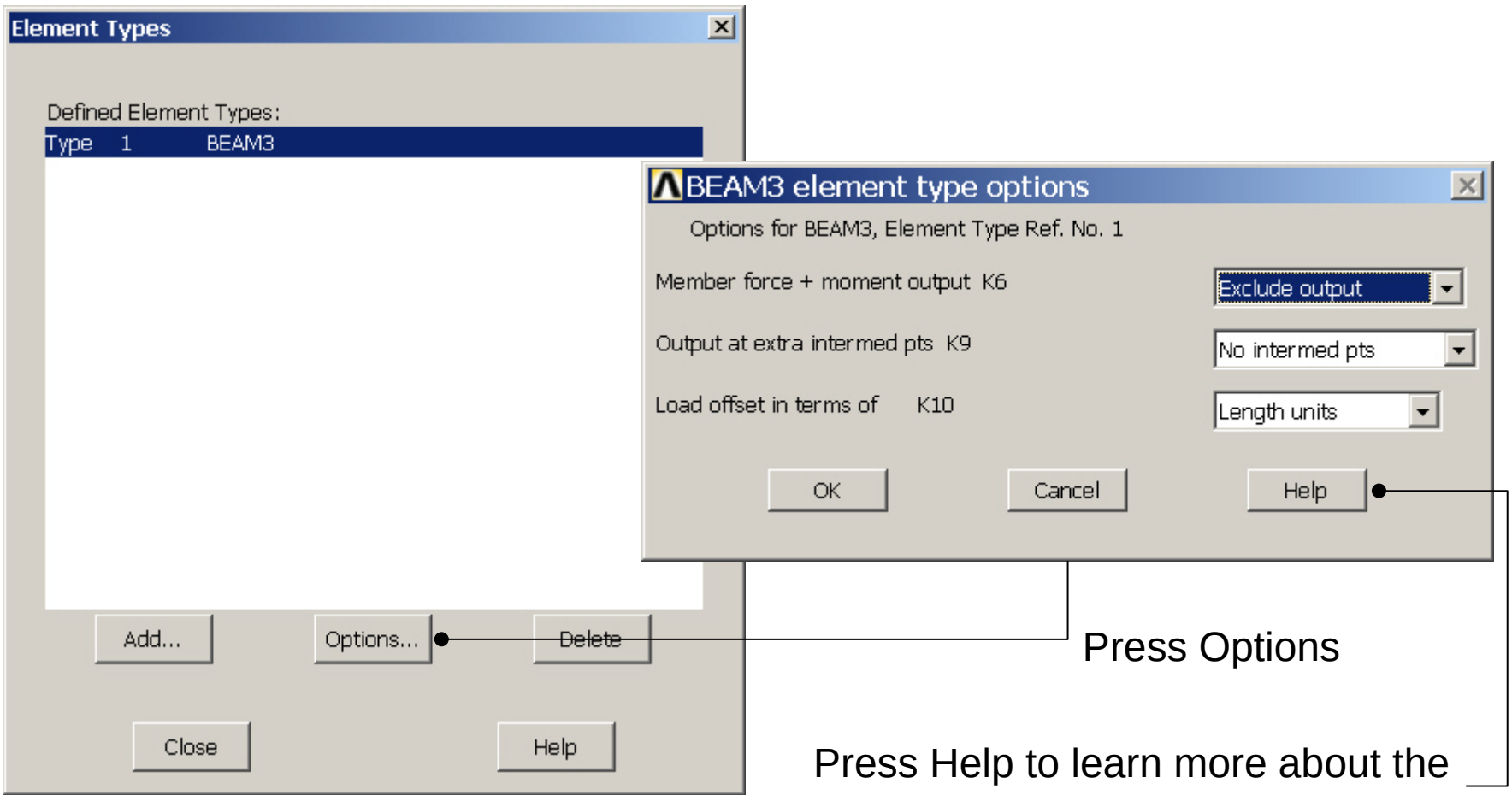
Example – Element Type

Preprocessor > Element Type > Add/Edit/Delete



Example - Element Type

Preprocessor > Element Type > Add/Edit/Delete

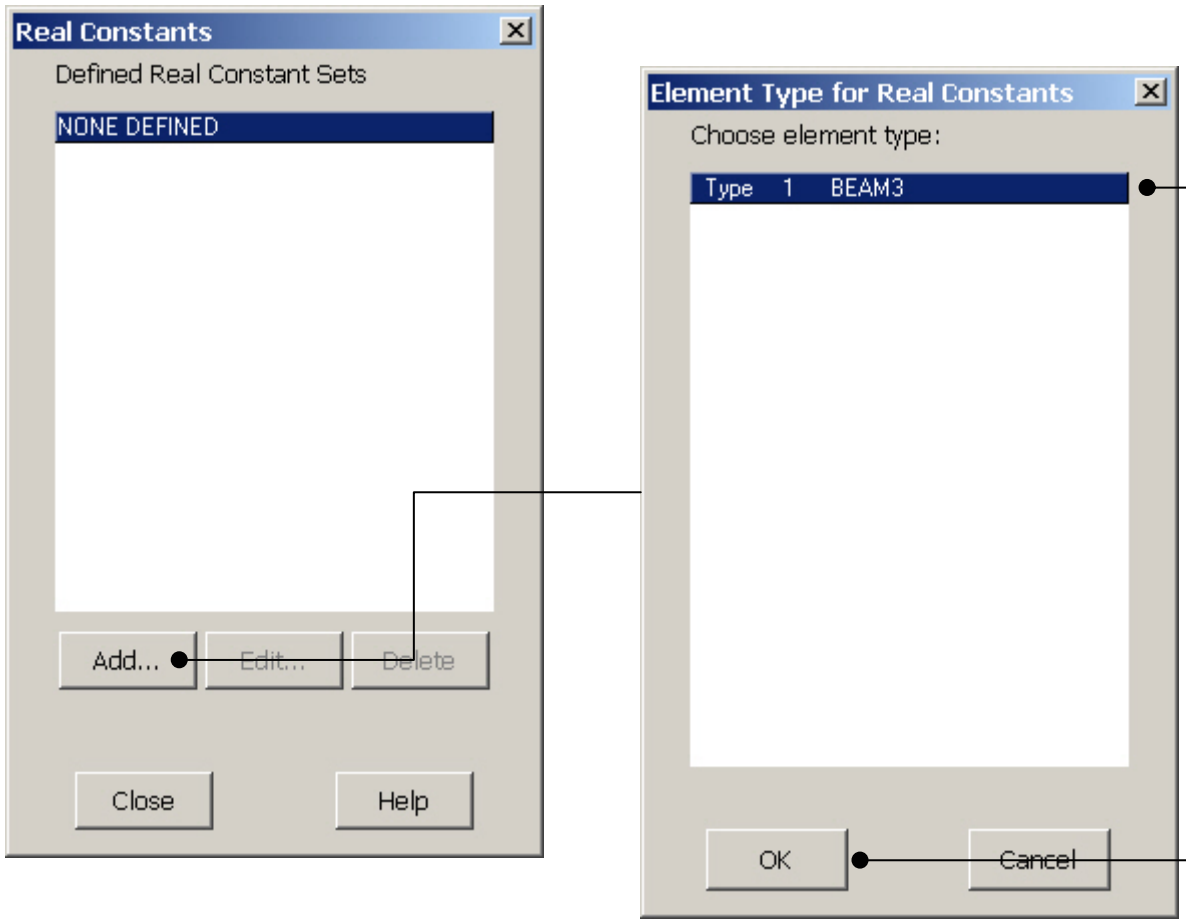


Press Options

Press Help to learn more about the element.

Example – Real Constants

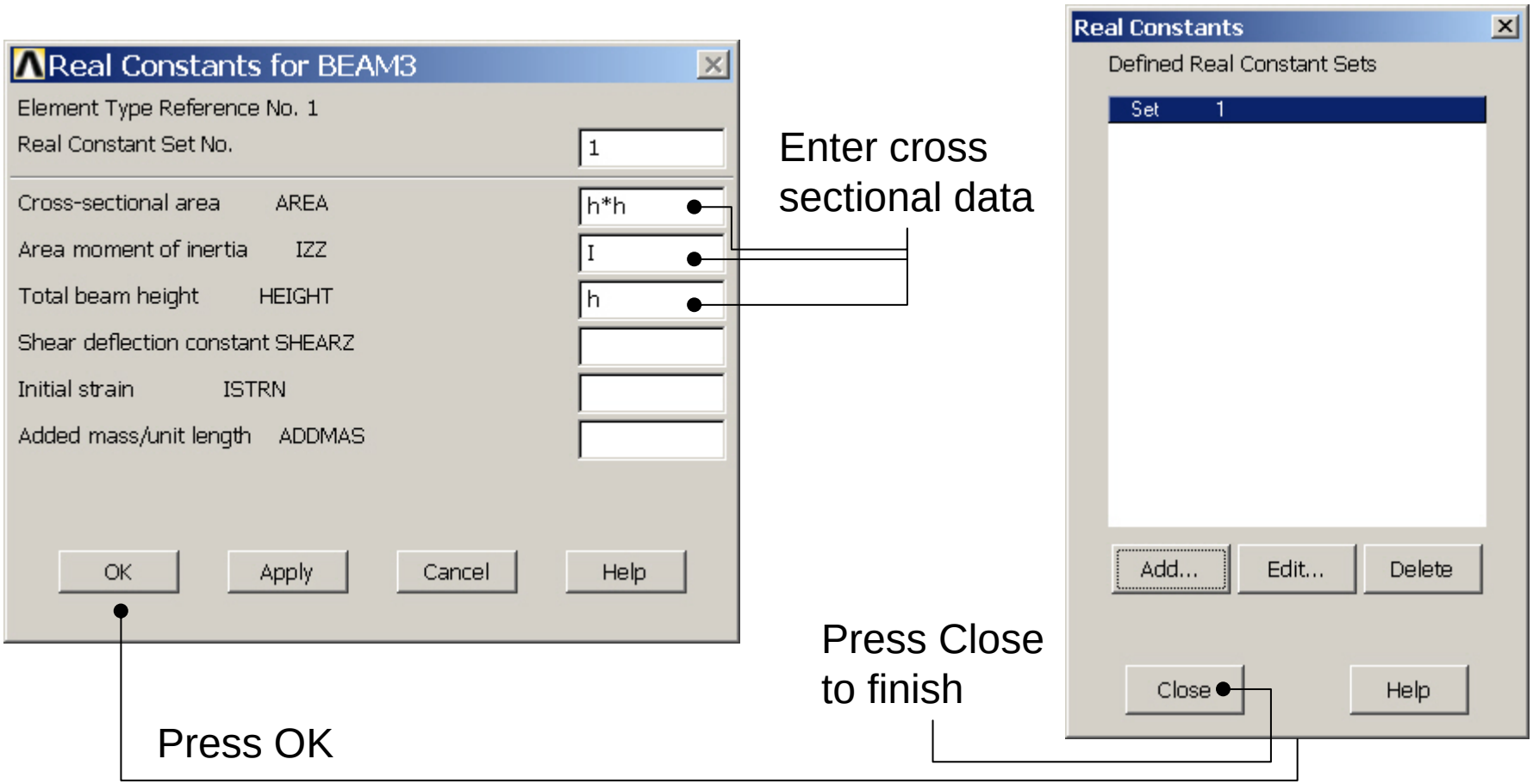
Preprocessor > Real Constants > Add



Place the cursor on the relevant element and press OK

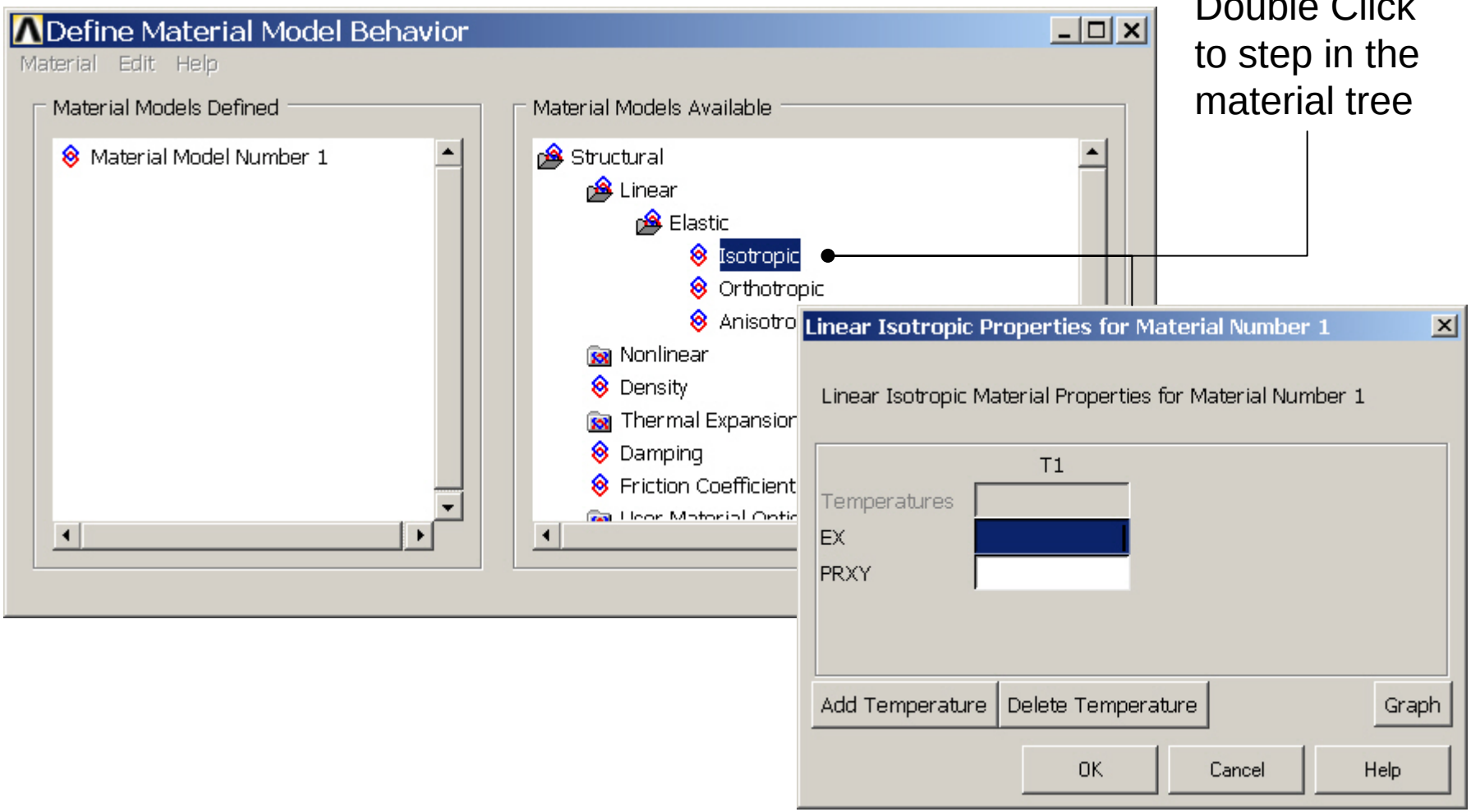
Example - Real Constants

Preprocessor > Real Constants > Add



Example - Material Properties

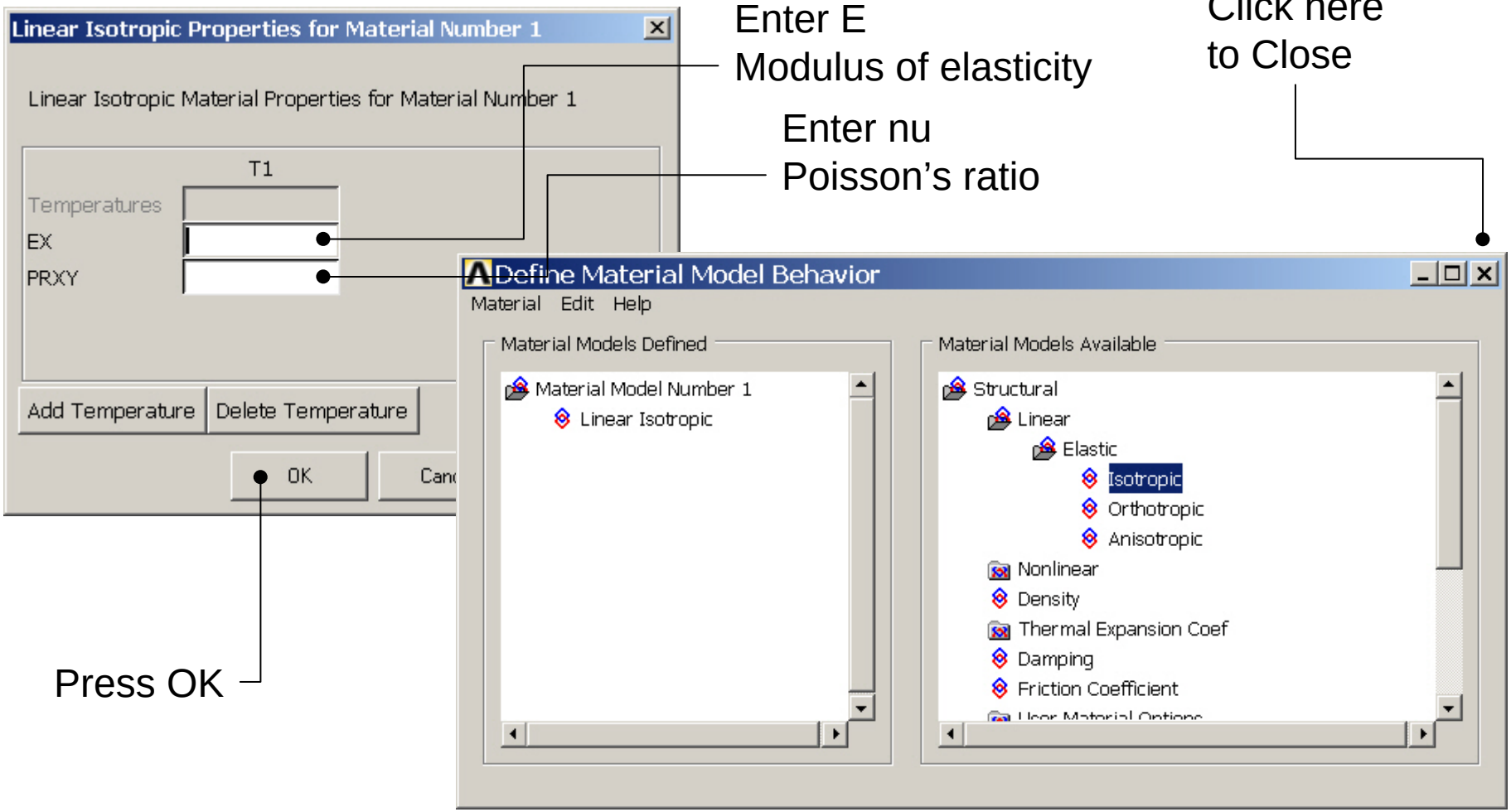
Preprocessor > Material Props > Material Models



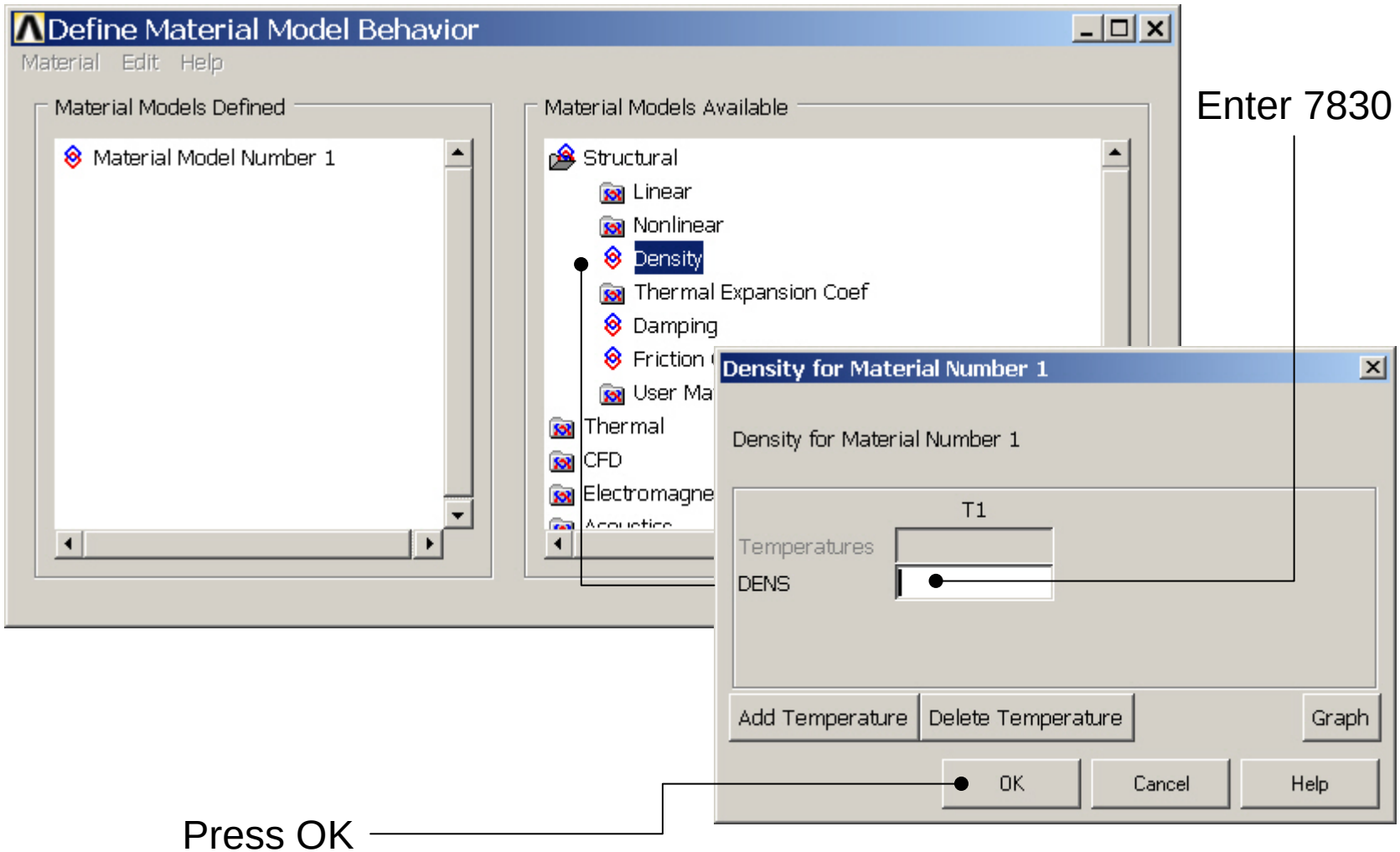
Double Click to step in the material tree

Example - Material Properties

Preprocessor > Material Props > Material Models

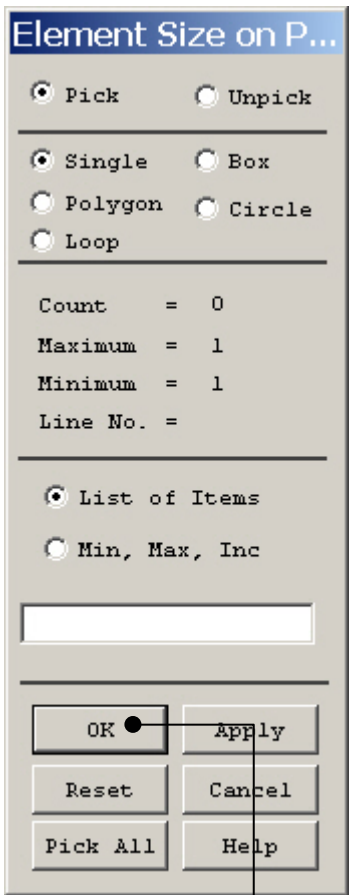


Example - Density

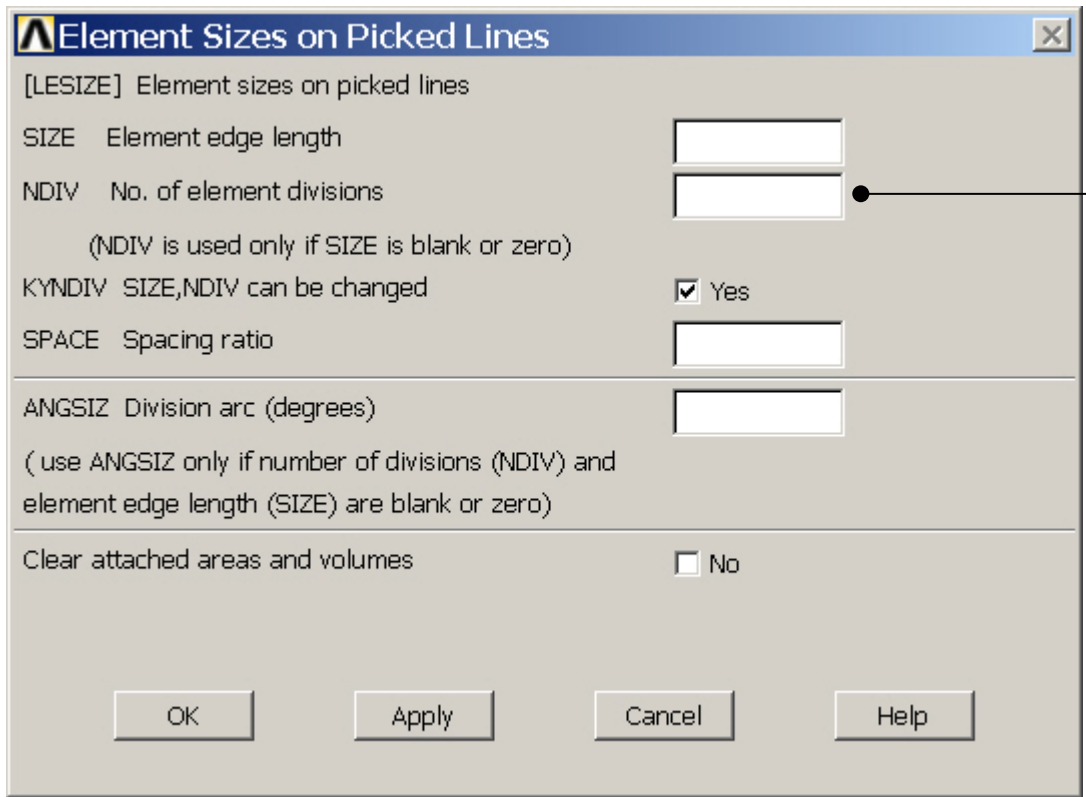


Example - Meshing

Preprocessor > Meshing > Size Cntrls > ManualSize > Lines > Picked Lines



Select/Pick L1

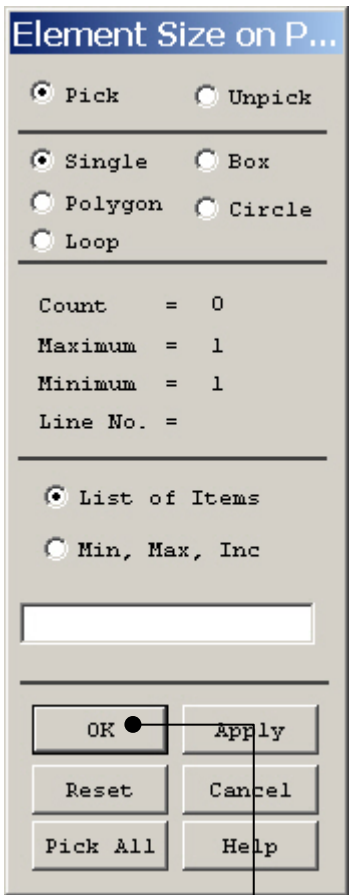


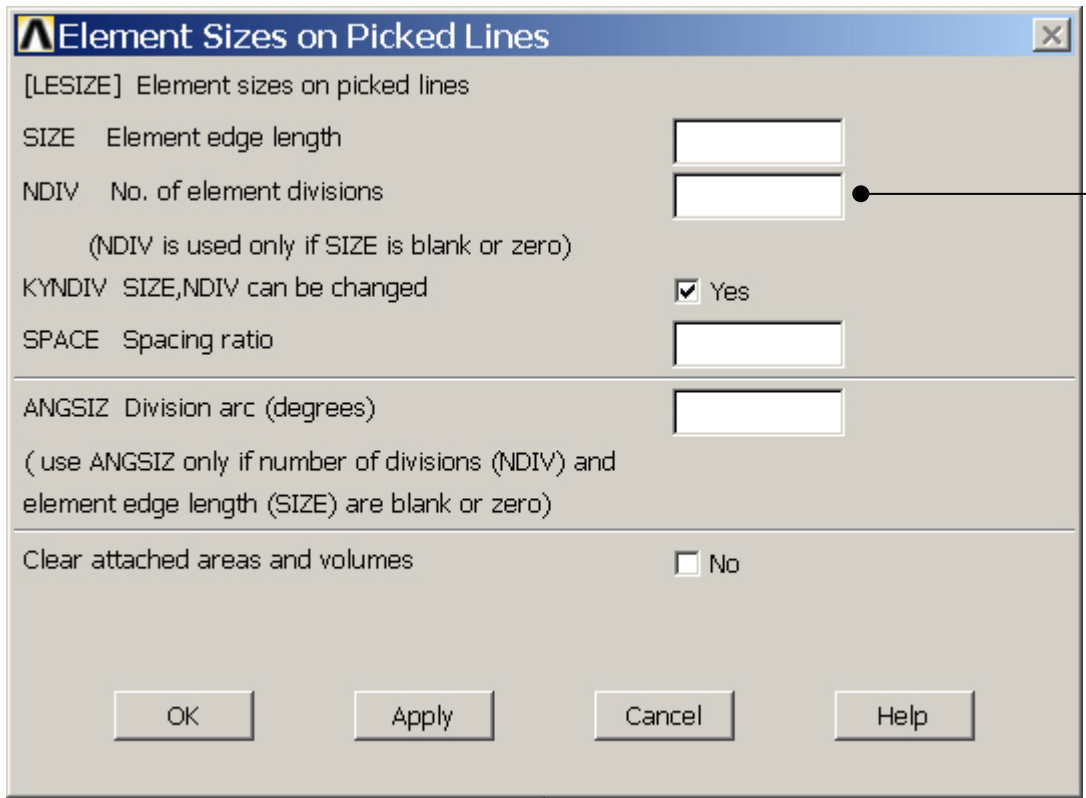
Press OK when finish with selection

Enter 30

Example - Meshing

Preprocessor > Meshing > Size Cntrls > ManualSize > Lines > Picked Lines





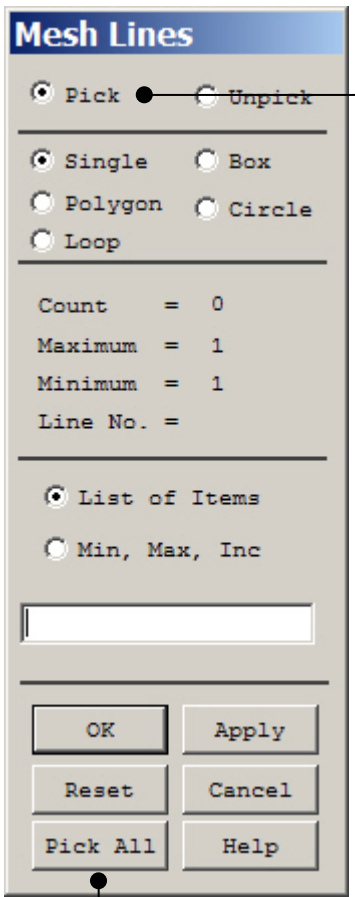
Select/Pick L2

Press OK when finish with selection

Enter 20

Example - Meshing

Preprocessor > Meshing > Mesh > Lines



Select individual lines to be meshed by Picking

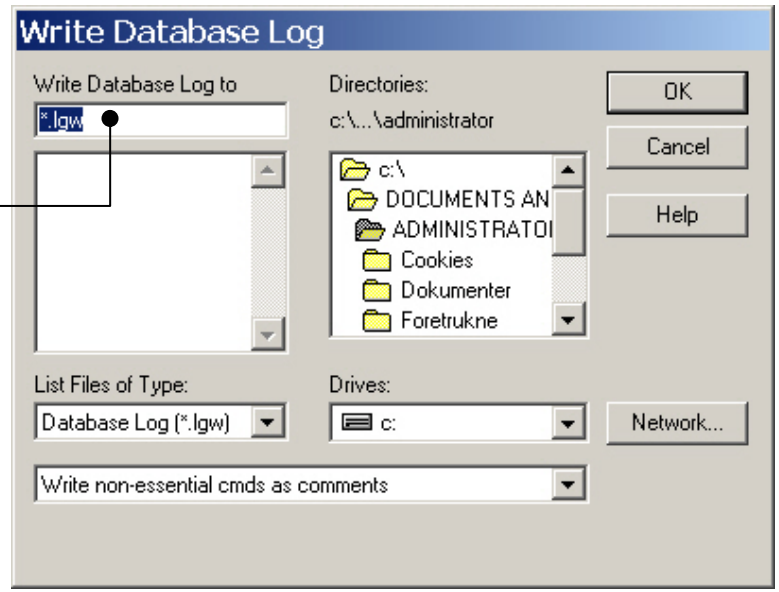
NB: It is often necessary to “Clear” the model for example if Element Type is to be changed

Select all lines defined to be meshed

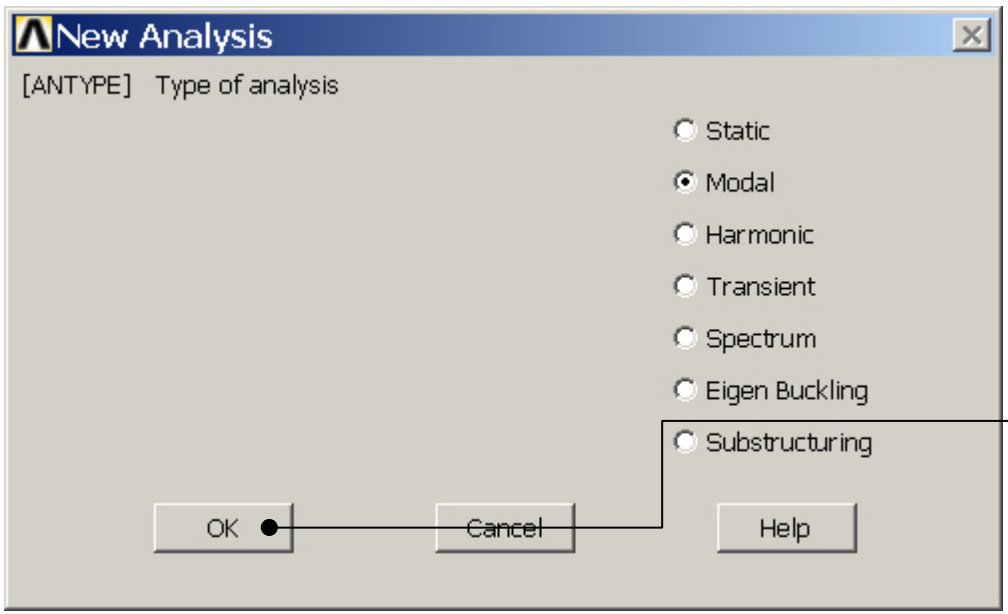
Example – Analysis Type

File > Write DB log file

Enter “example0410.lgw”

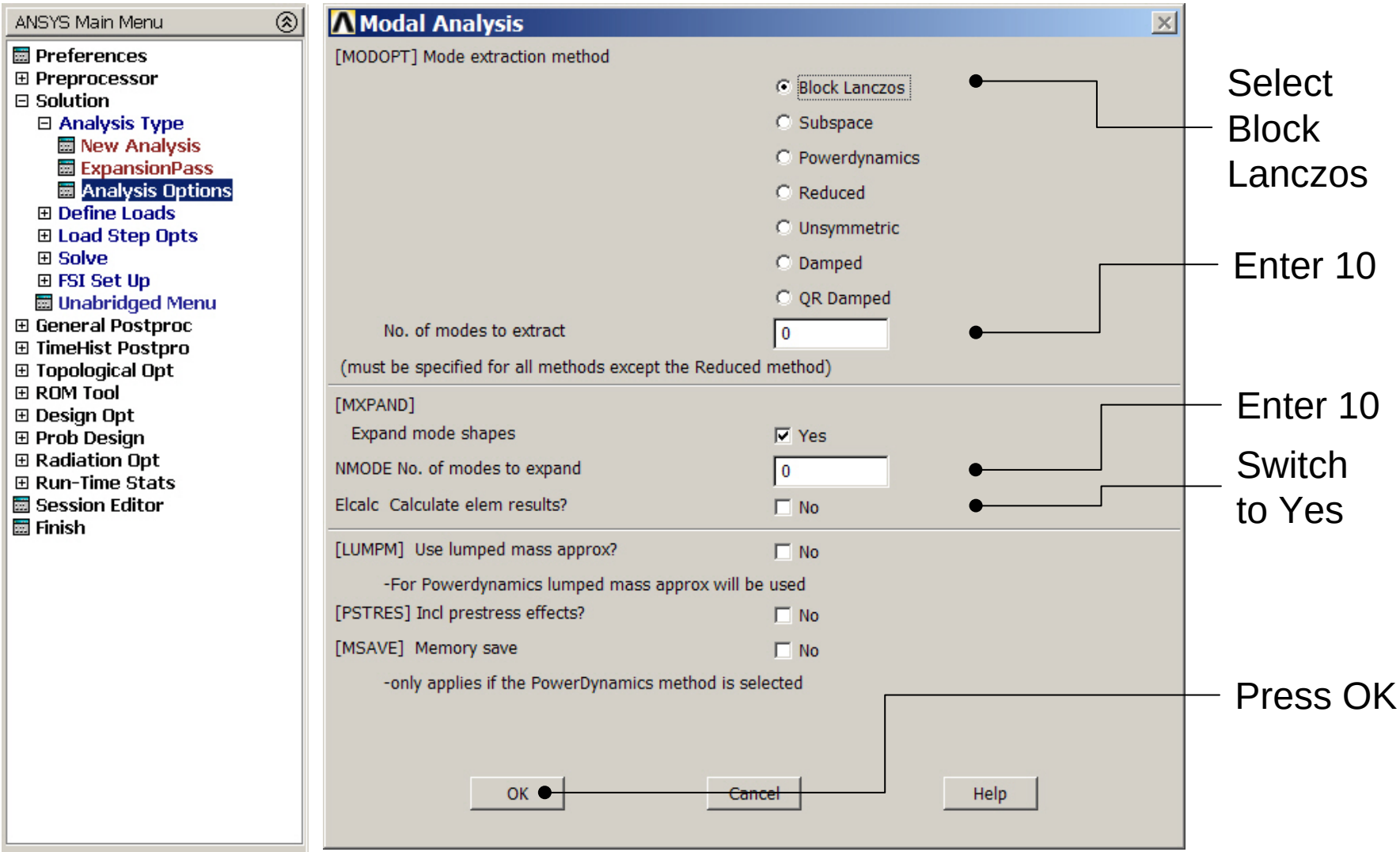


Solution > Analysis Type > New Analysis

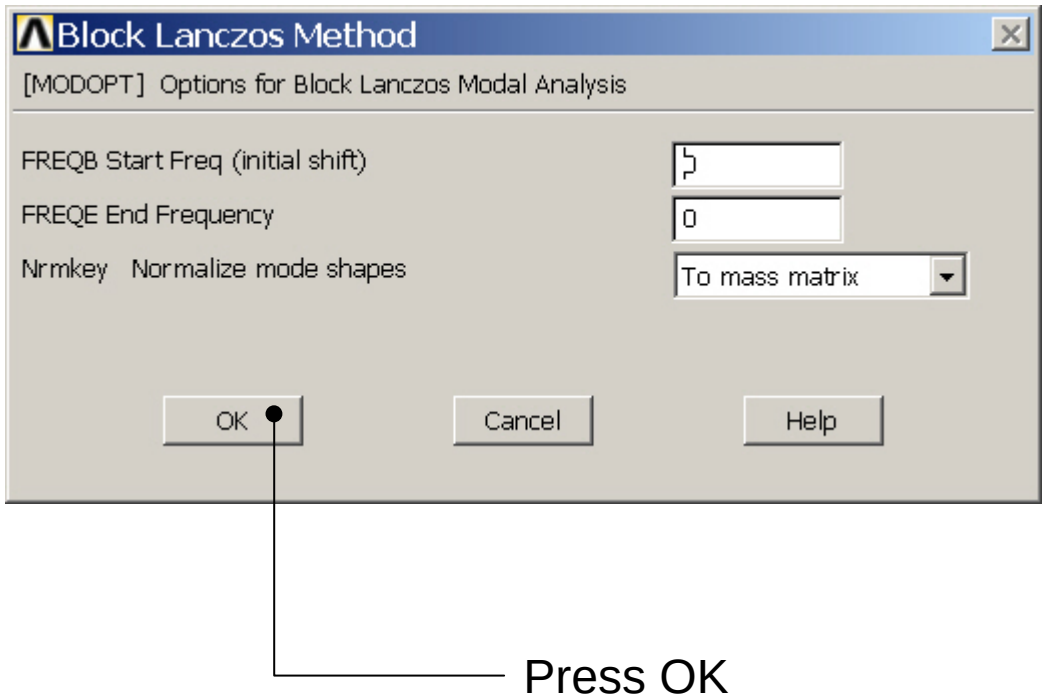


Press OK

Example – MA Analysis Options

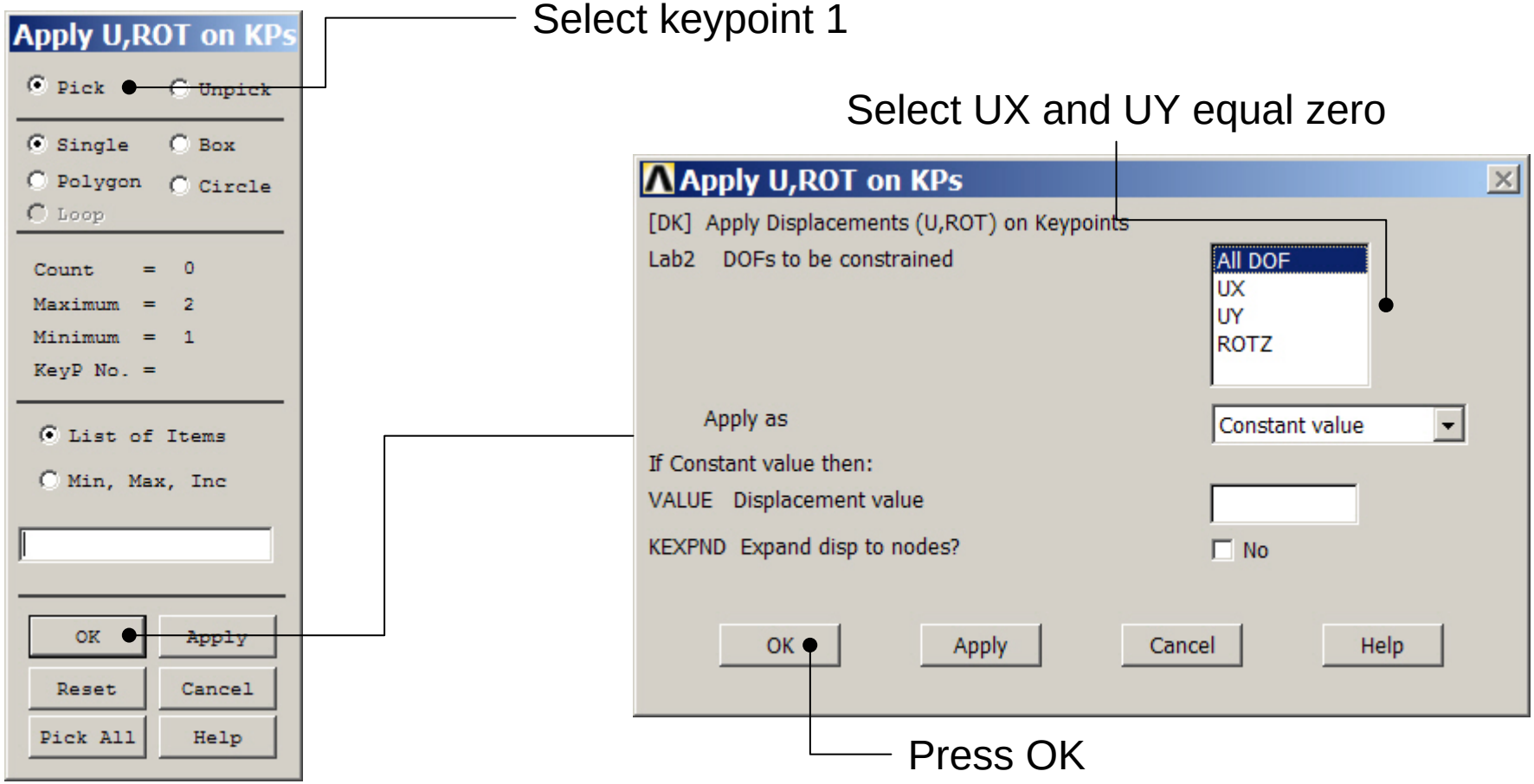


Example – MA Analysis Options



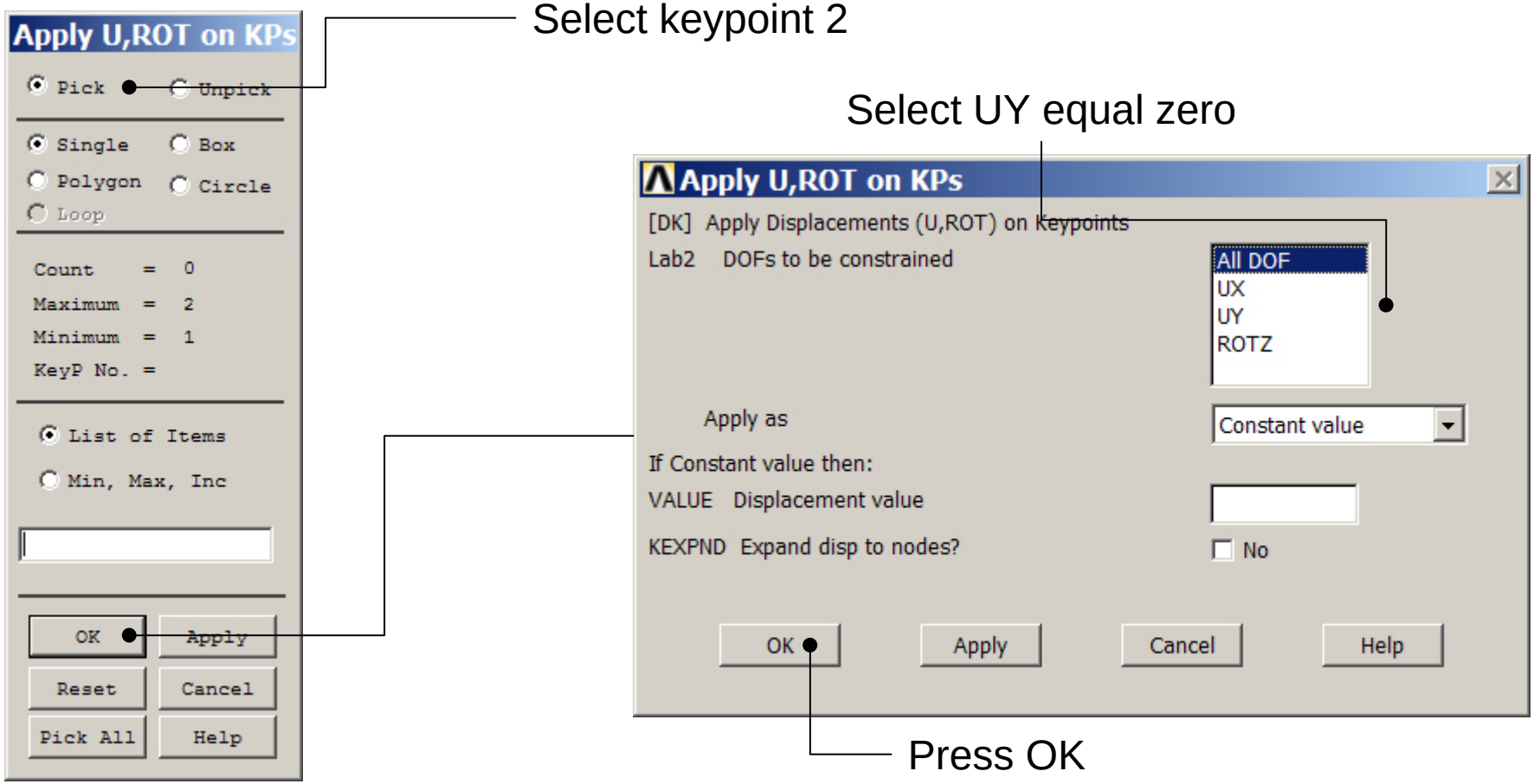
Example – Define Loads

Solution > Define Loads > Apply > Structural > Displacement > On Keypoints

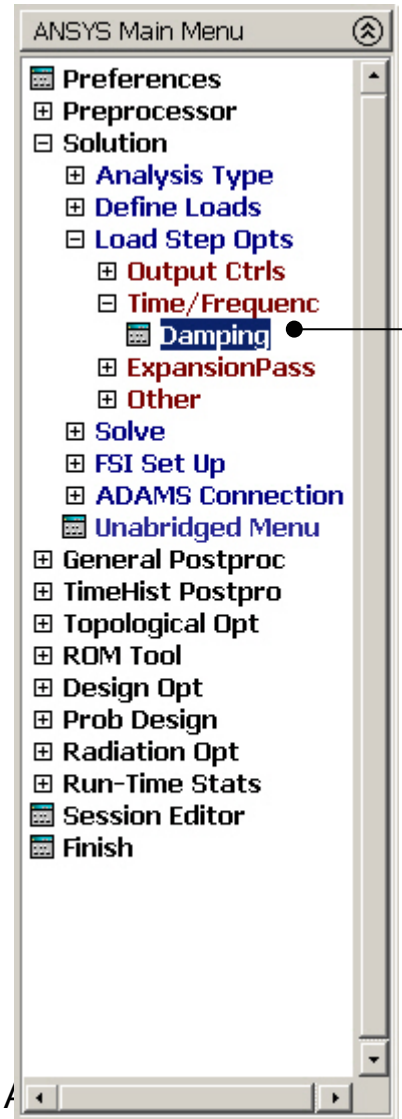


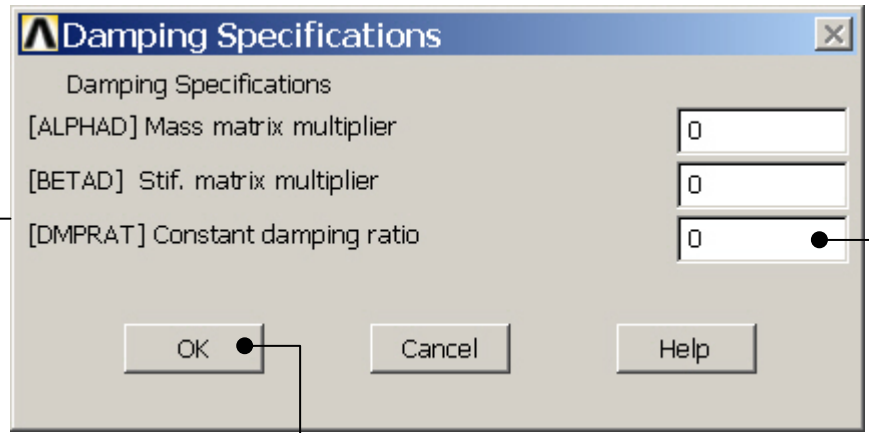
Example – Define Loads

Solution > Define Loads > Apply > Structural > Displacement > On Keypoints



Example - Damping



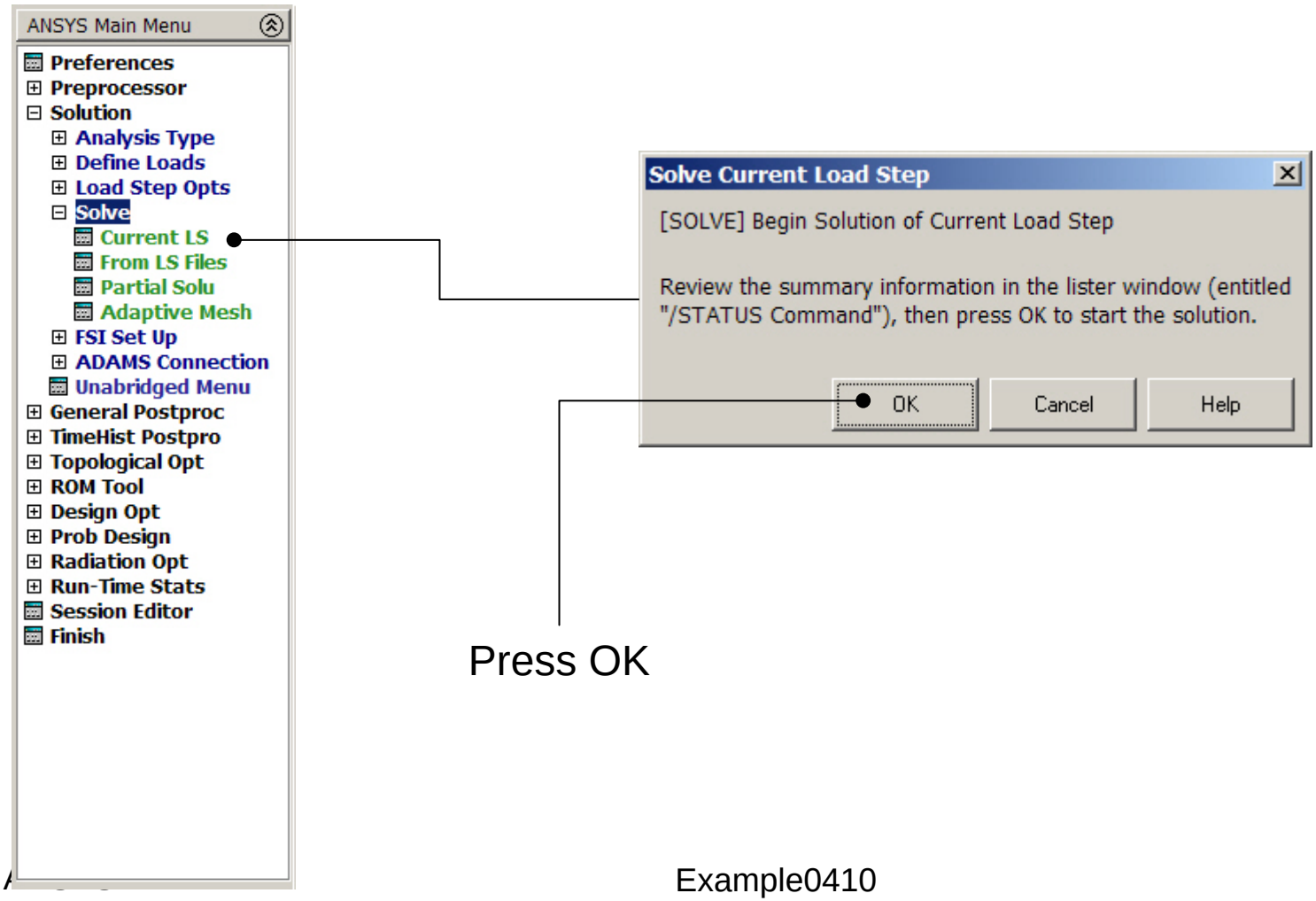


Press OK

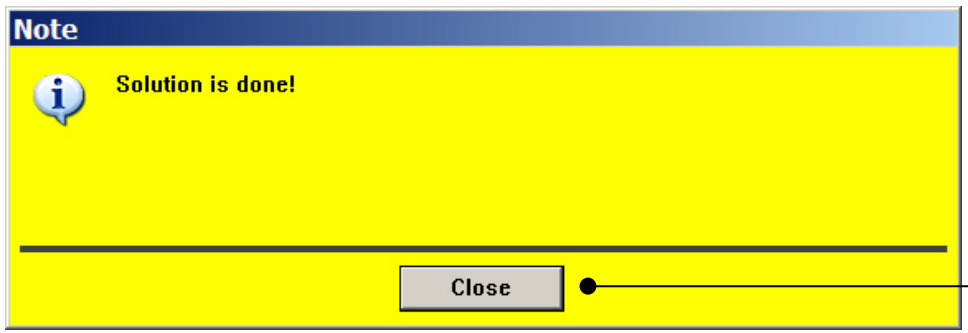
Enter 0.02 for Constant damping ratio

Example - Solve

Solution > Solve > Current LS

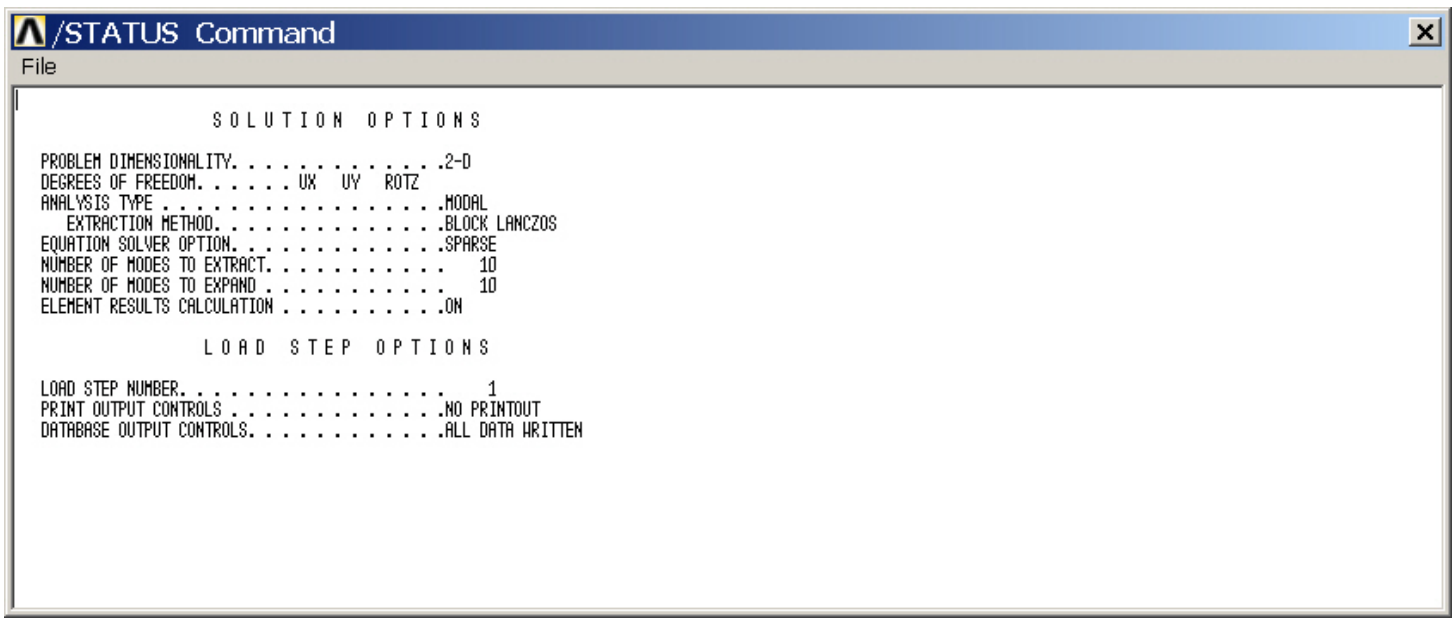


Example - Solve



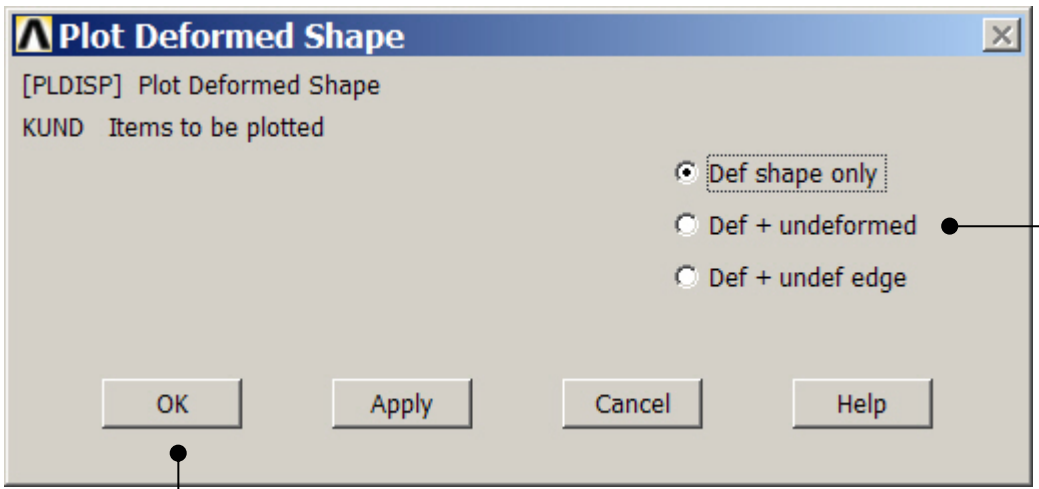
Press Close

Press here
to Close



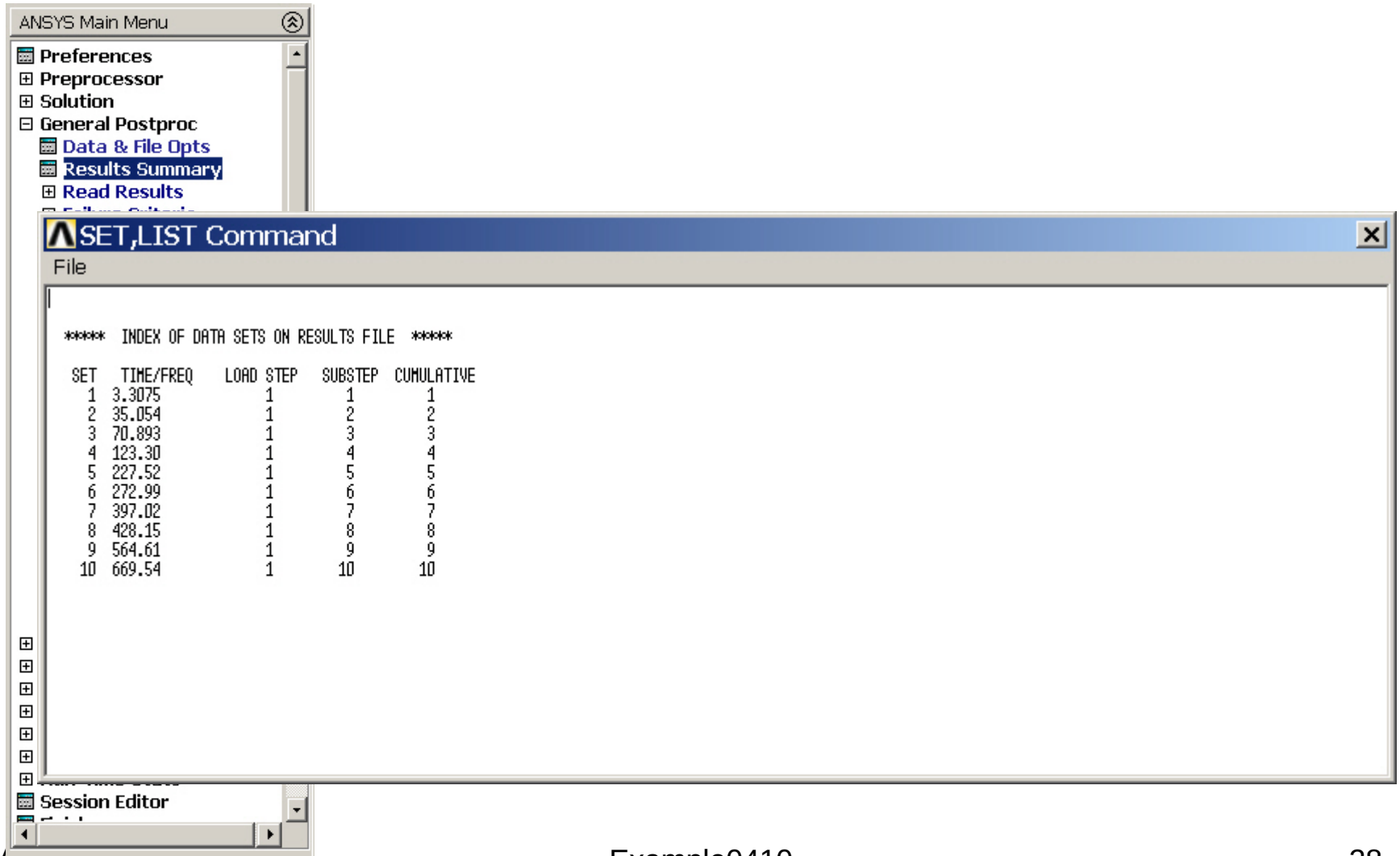
Example - PostProcessing

General Postproc > Plot Results > Deformed Shape

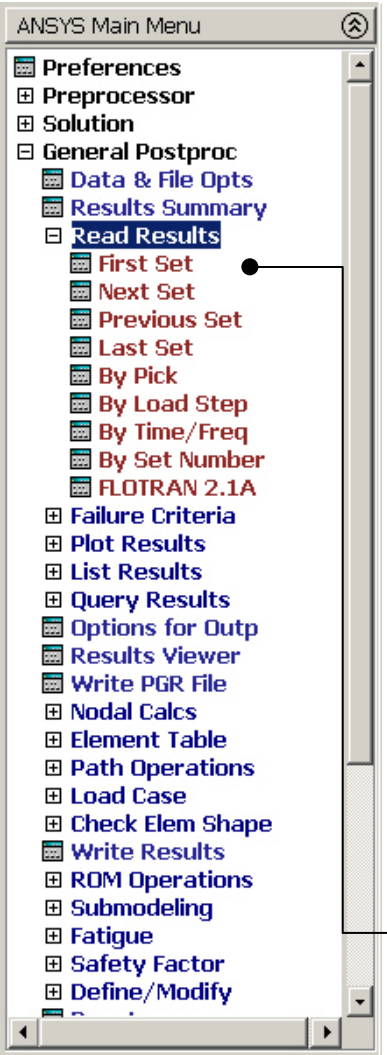


Select “Def+undeformed” and Press OK

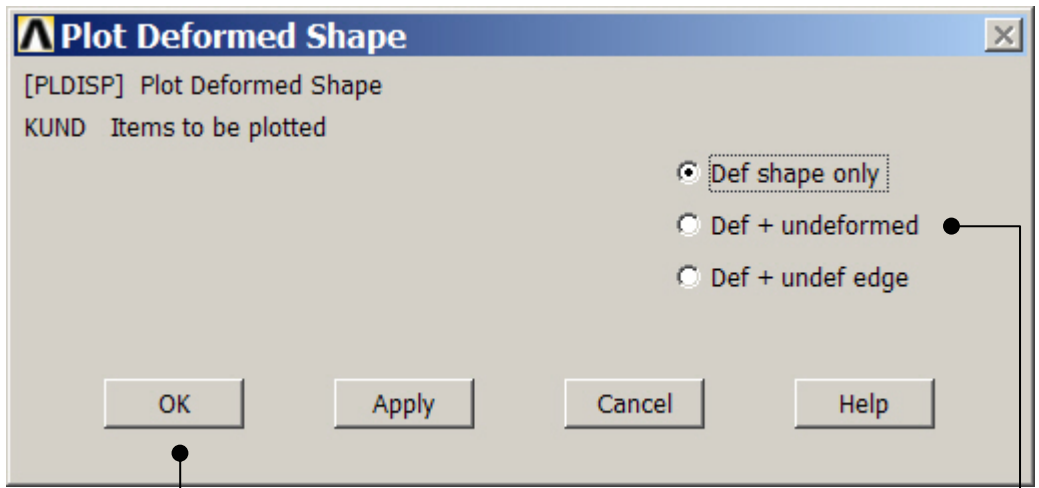
Example – Results Summary



Example – Read Results



General Postproc > Plot Results > Deformed Shape

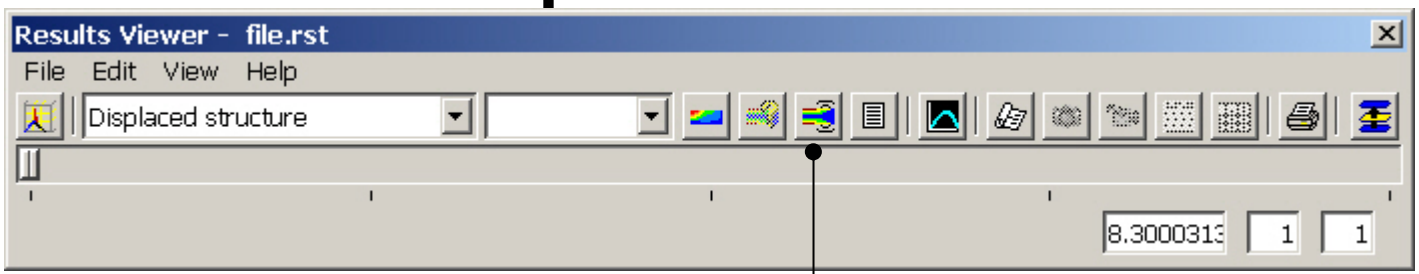


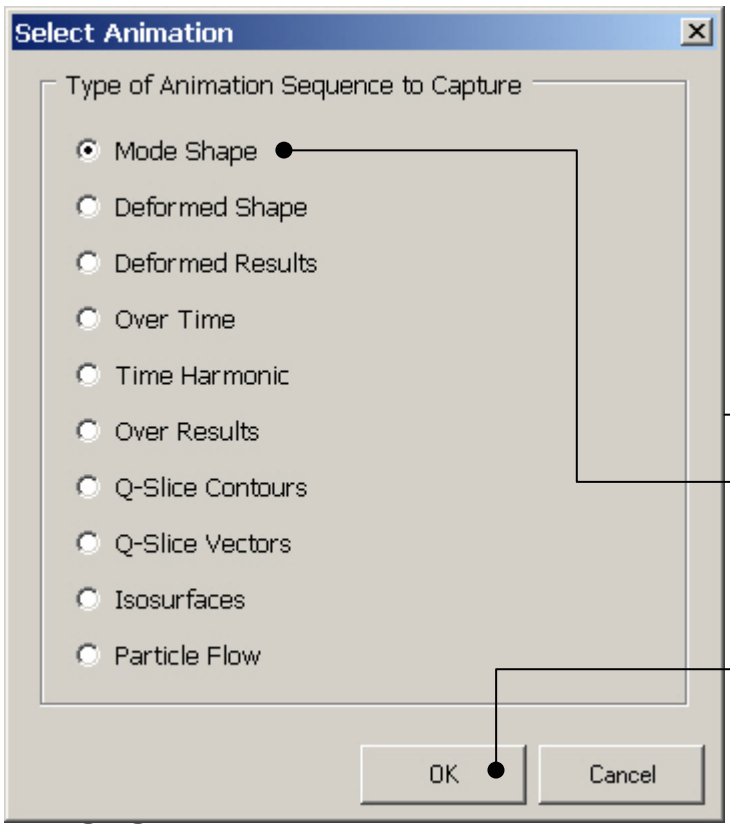
Select “Def+undeformed” and Press OK

Read first set

Example – Mode 1

Example – Result viewer



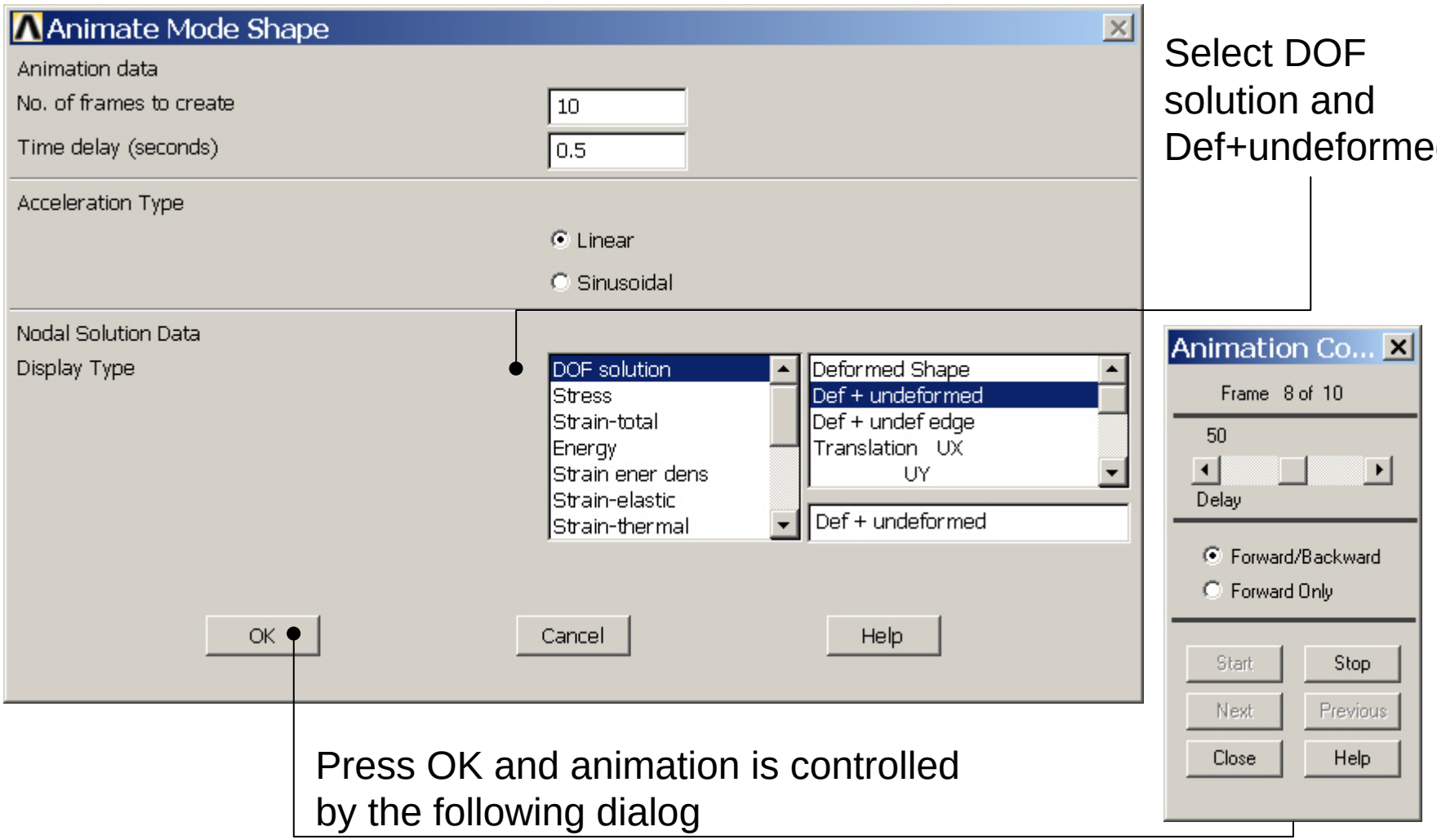


Select mode shape, the last mode read is displayed

Press OK

Example0410

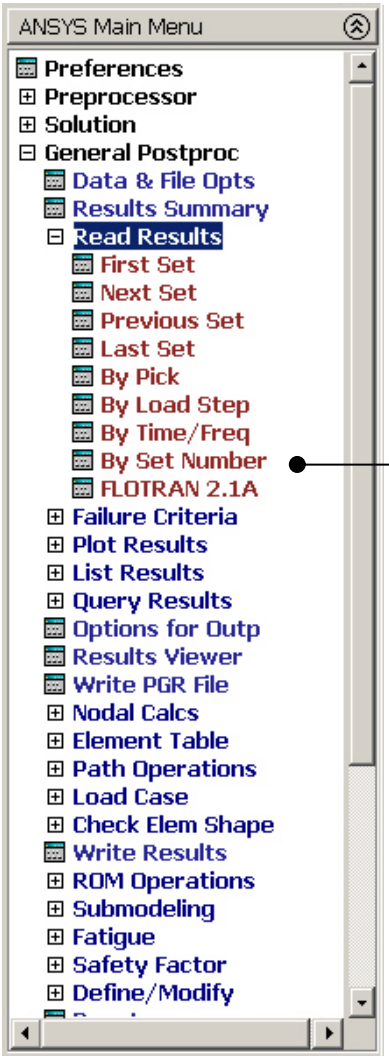
Example – Result viewer

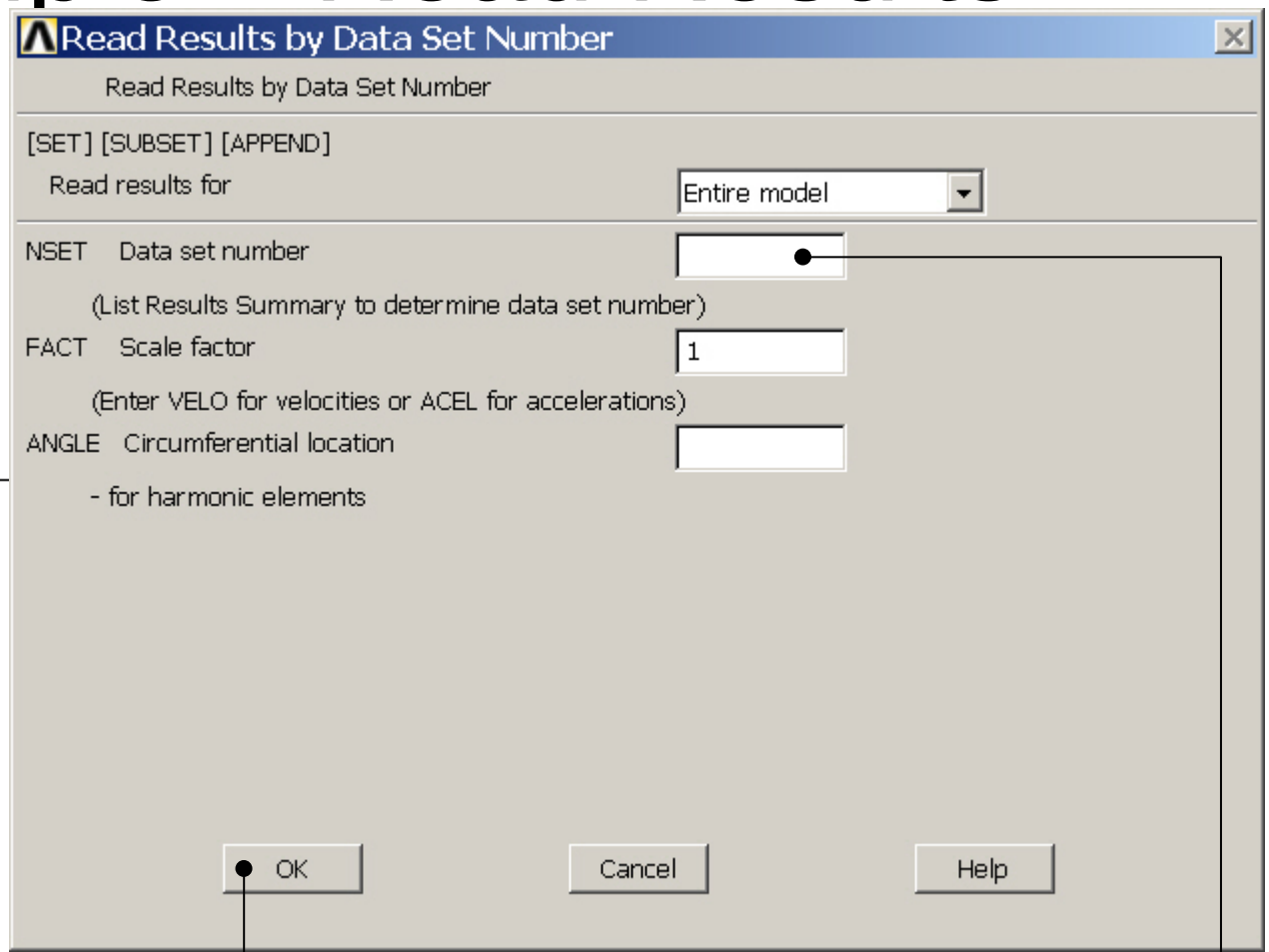


Select DOF solution and Def+undeformed

Press OK and animation is controlled by the following dialog

Example – Read Results

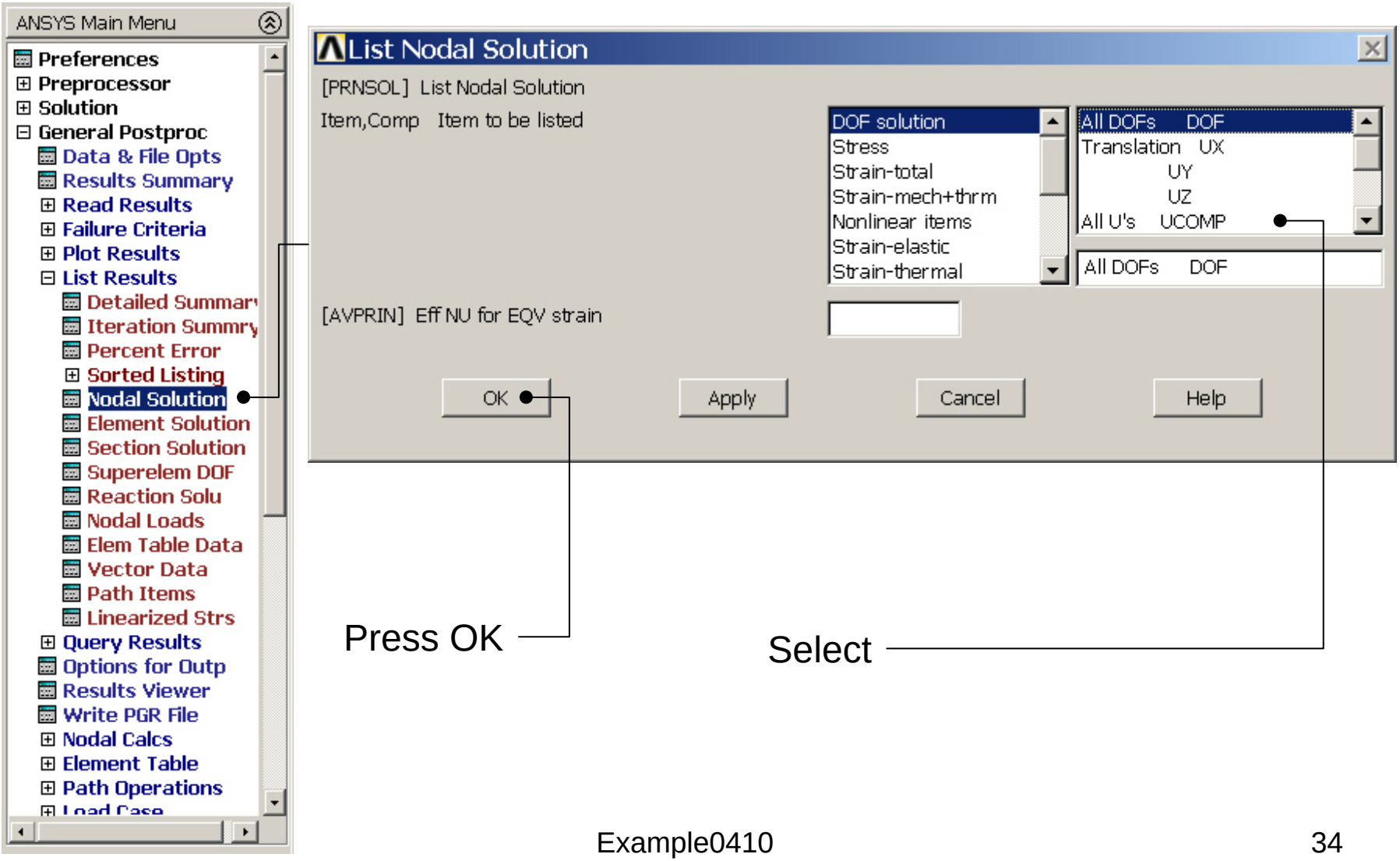




Press OK

Enter 3 and compare with Cook

Example - List



Example - List

PRNSOL Command

File

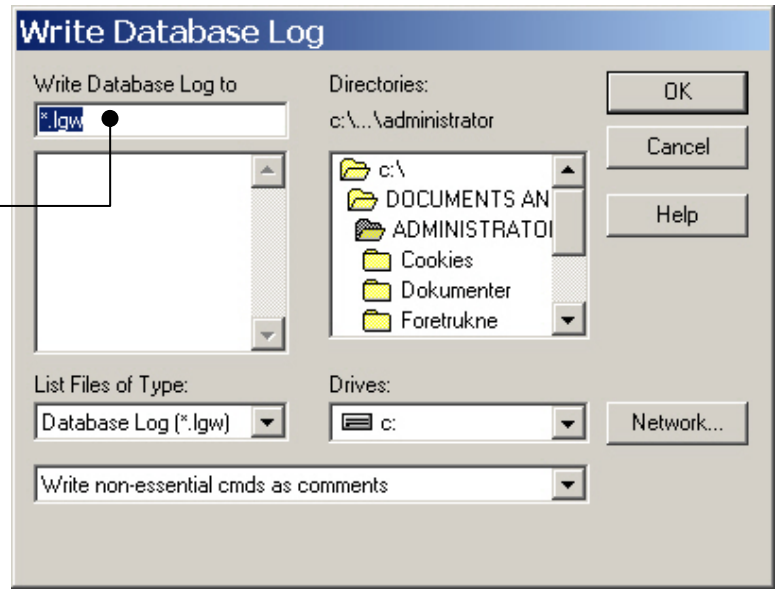
```
PRINT U    NODAL SOLUTION PER NODE

 ***** POST1 NODAL DEGREE OF FREEDOM LISTING *****

 LOAD STEP=     1  SUBSTEP=     3
  FREQ=    70.893      LOAD CASE=   0

 THE FOLLOWING DEGREE OF FREEDOM RESULTS ARE IN GLOBAL COORDINATES

   NODE      UX          UY          UZ          USUM
      1   0.0000      0.0000      0.0000      0.0000
      2 -0.33208E-02-0.17676E-02  0.0000     0.37619E-02
      3  0.76118E-02-0.59615E-04  0.0000     0.76120E-02
      4  0.14995E-01-0.11923E-03  0.0000     0.14995E-01
      5  0.21928E-01-0.17883E-03  0.0000     0.21928E-01
      6  0.28203E-01-0.23841E-03  0.0000     0.28204E-01
      7  0.33632E-01-0.29798E-03  0.0000     0.33634E-01
      8  0.38057E-01-0.35753E-03  0.0000     0.38058E-01
      9  0.41346E-01-0.41704E-03  0.0000     0.41348E-01
     10  0.43405E-01-0.47653E-03  0.0000     0.43408E-01
     11  0.44181E-01-0.53598E-03  0.0000     0.44184E-01
     12  0.43657E-01-0.59538E-03  0.0000     0.43661E-01
     13  0.41861E-01-0.65474E-03  0.0000     0.41866E-01
     14  0.38859E-01-0.71405E-03  0.0000     0.38865E-01
     15  0.34758E-01-0.77330E-03  0.0000     0.34766E-01
     16  0.29700E-01-0.83250E-03  0.0000     0.29711E-01
     17  0.23860E-01-0.89162E-03  0.0000     0.23877E-01
     18  0.17442E-01-0.95068E-03  0.0000     0.17468E-01
     19  0.10669E-01-0.10097E-02  0.0000     0.10717E-01
     20  0.37842E-02-0.10686E-02  0.0000     0.39322E-02
     21 -0.29622E-02-0.11274E-02  0.0000     0.31695E-02
     22 -0.93152E-02-0.11861E-02  0.0000     0.93904E-02
     23 -0.15023E-01-0.12448E-02  0.0000     0.15074E-01
     24 -0.19841E-01-0.13033E-02  0.0000     0.19884E-01
     25 -0.23541E-01-0.13618E-02  0.0000     0.23580E-01
```

Compare result with Cook

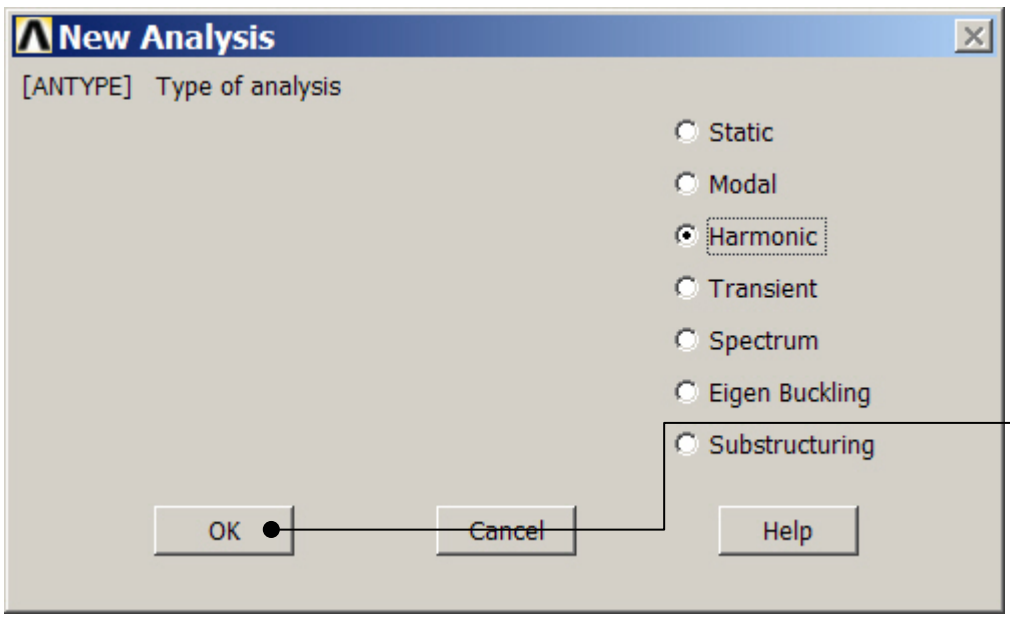
Example – Analysis Type

File > Write DB log file

Enter “example0410.lgw”

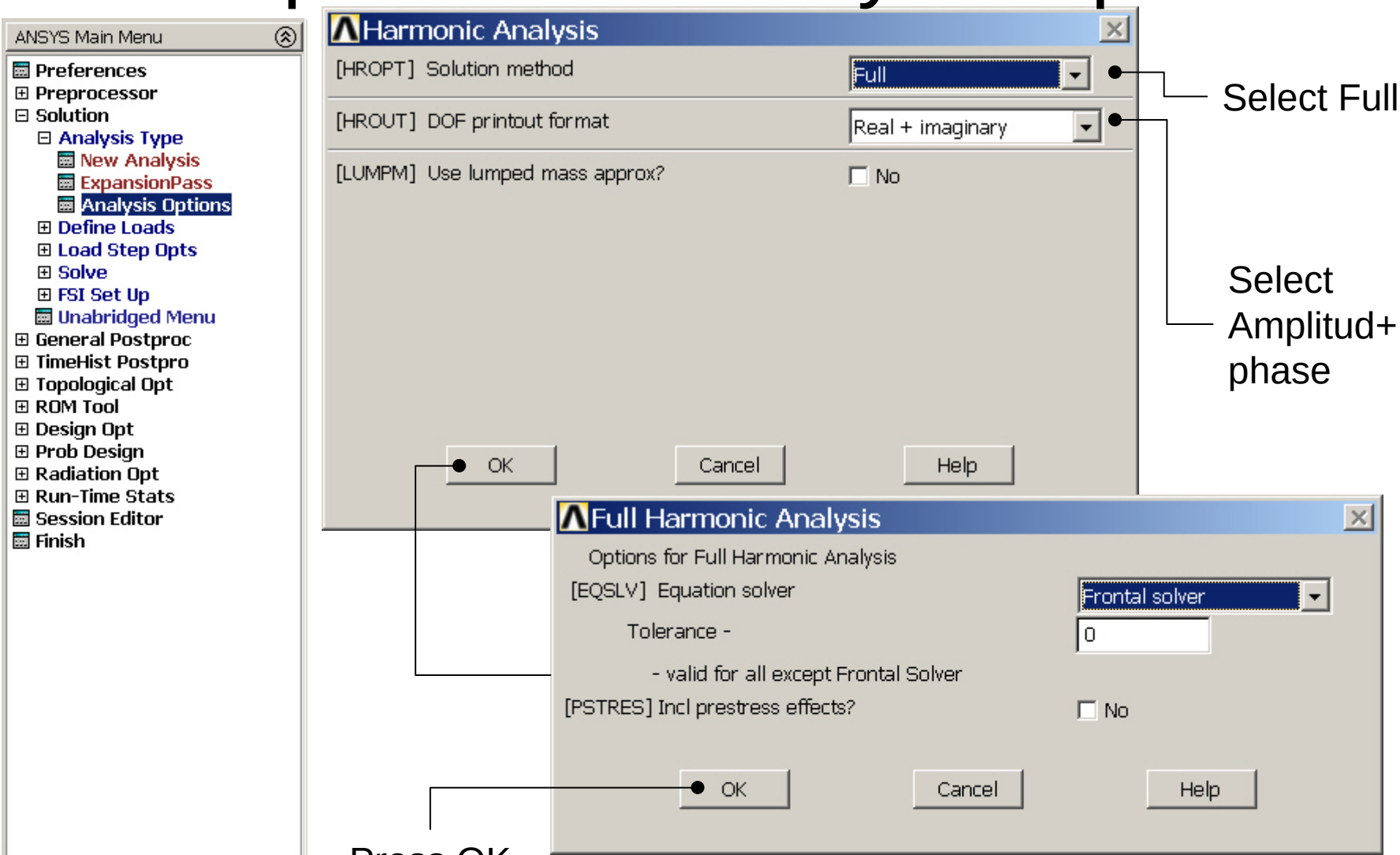


Solution > Analysis Type > New Analysis



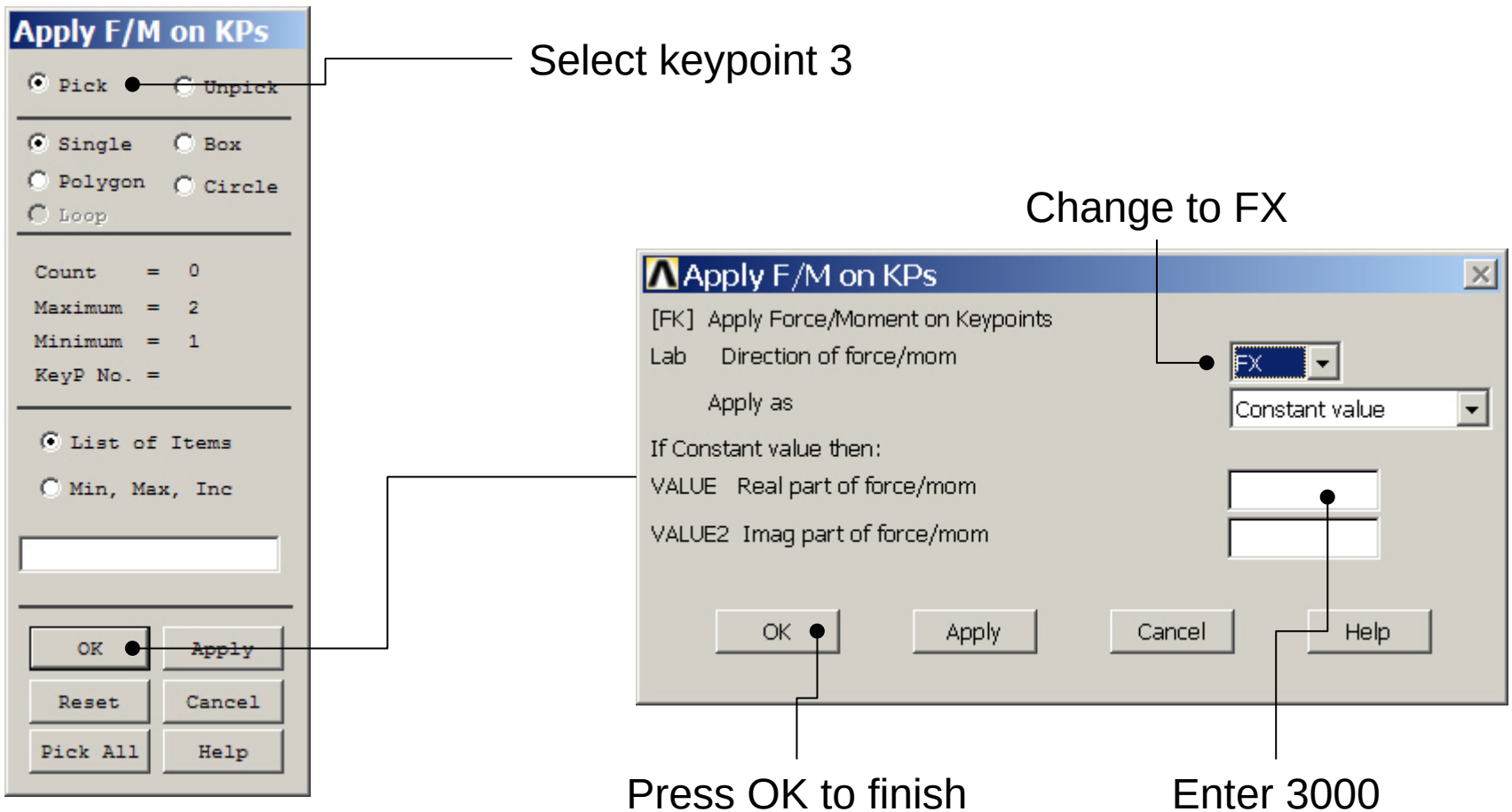
Press OK

Example – HRA Analysis Options

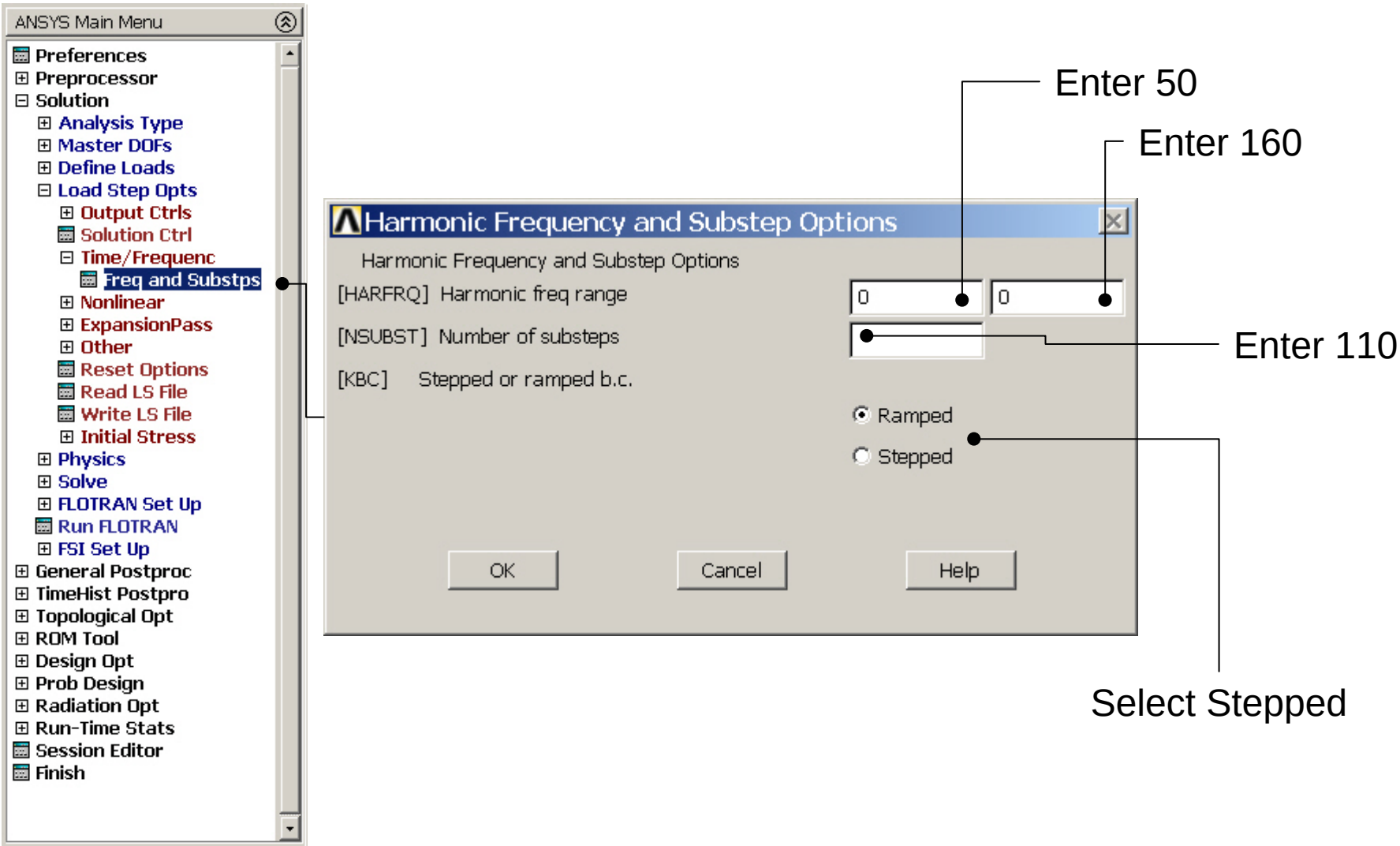


Example – Define Loads

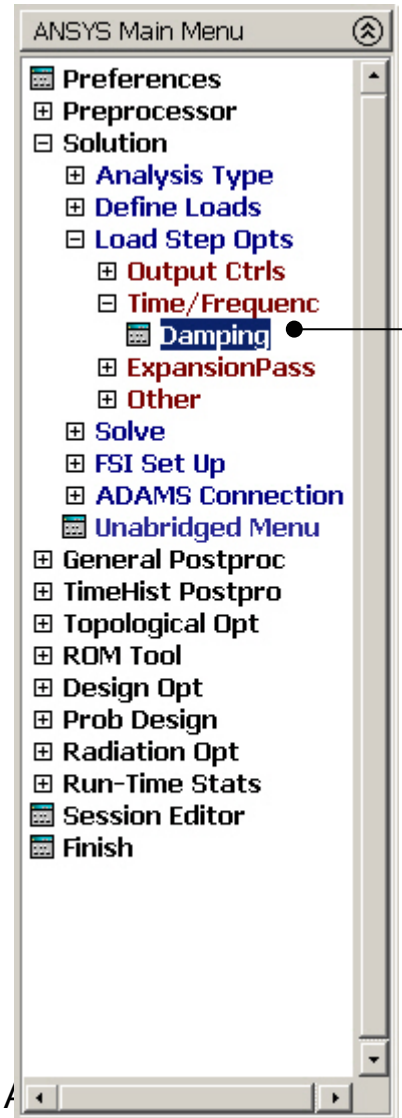
Solution > Define Loads > Apply > Structural > Force/Moment > On Keypoints

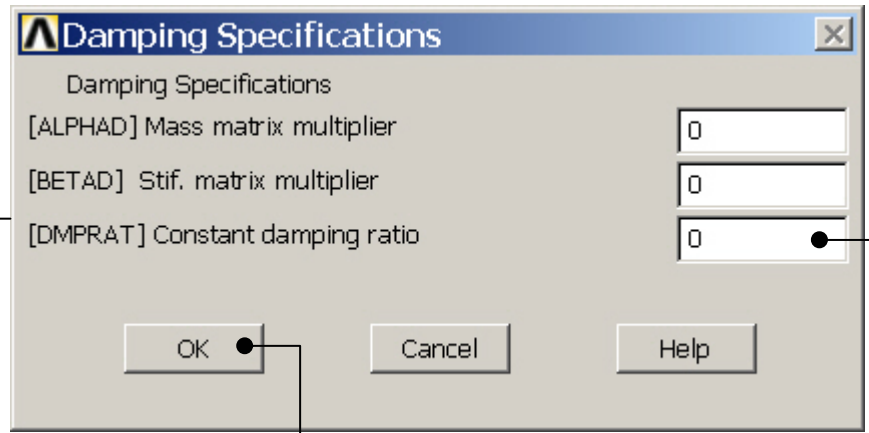


Example - Freq and Substps



Example - Damping



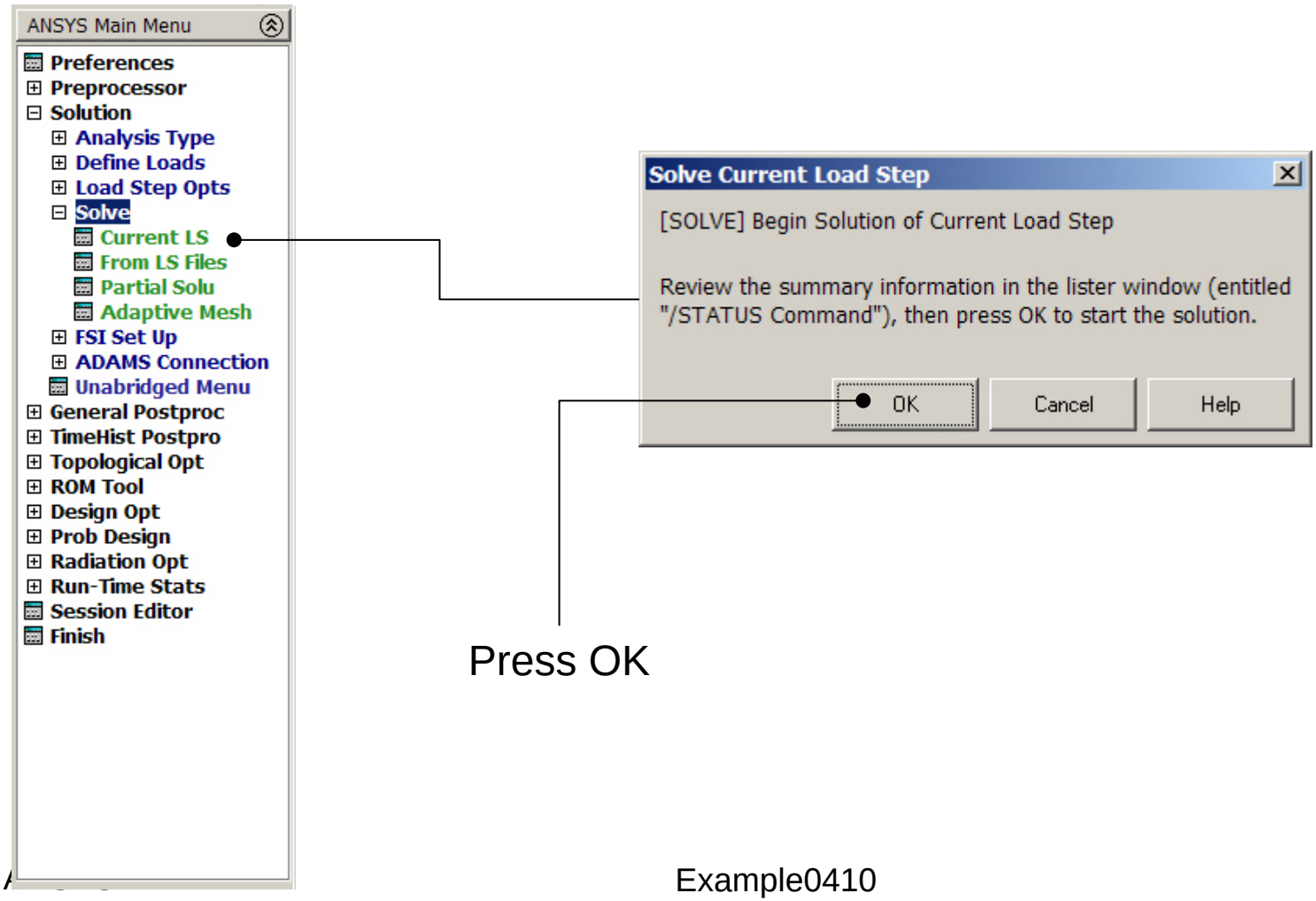


Press OK

Enter 0.02 for Constant damping ratio

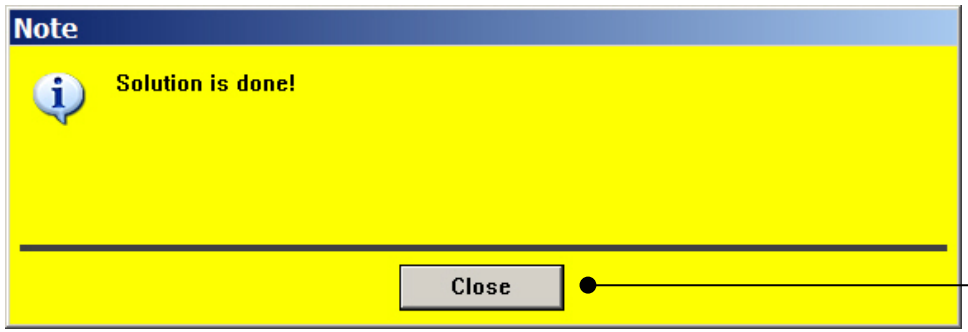
Example - Solve

Solution > Solve > Current LS



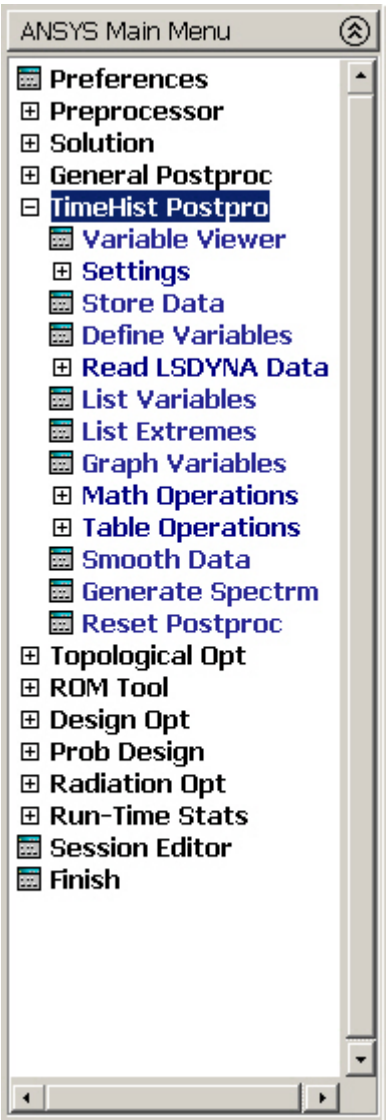
Press OK

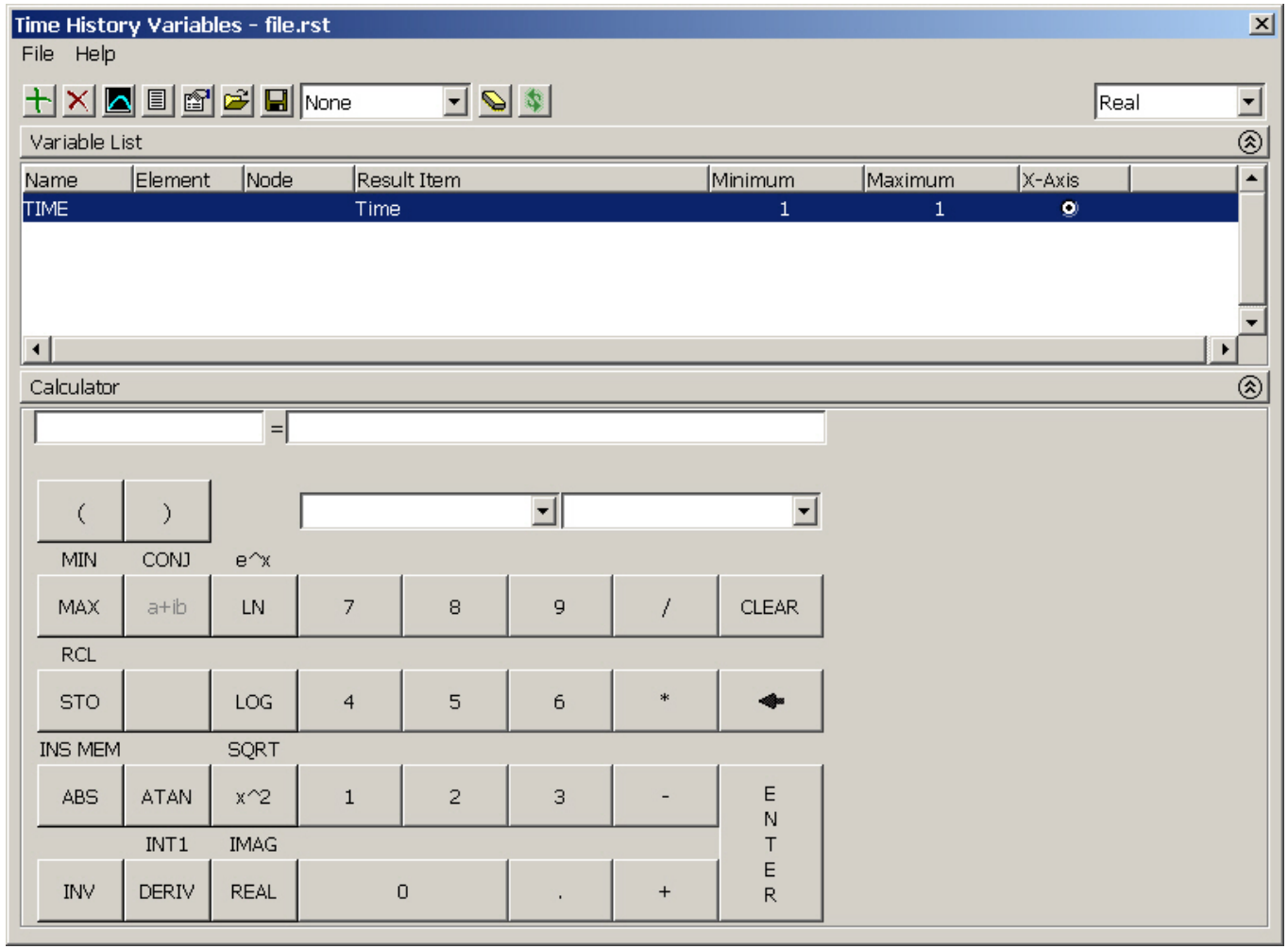
Example - Solve



Press Close

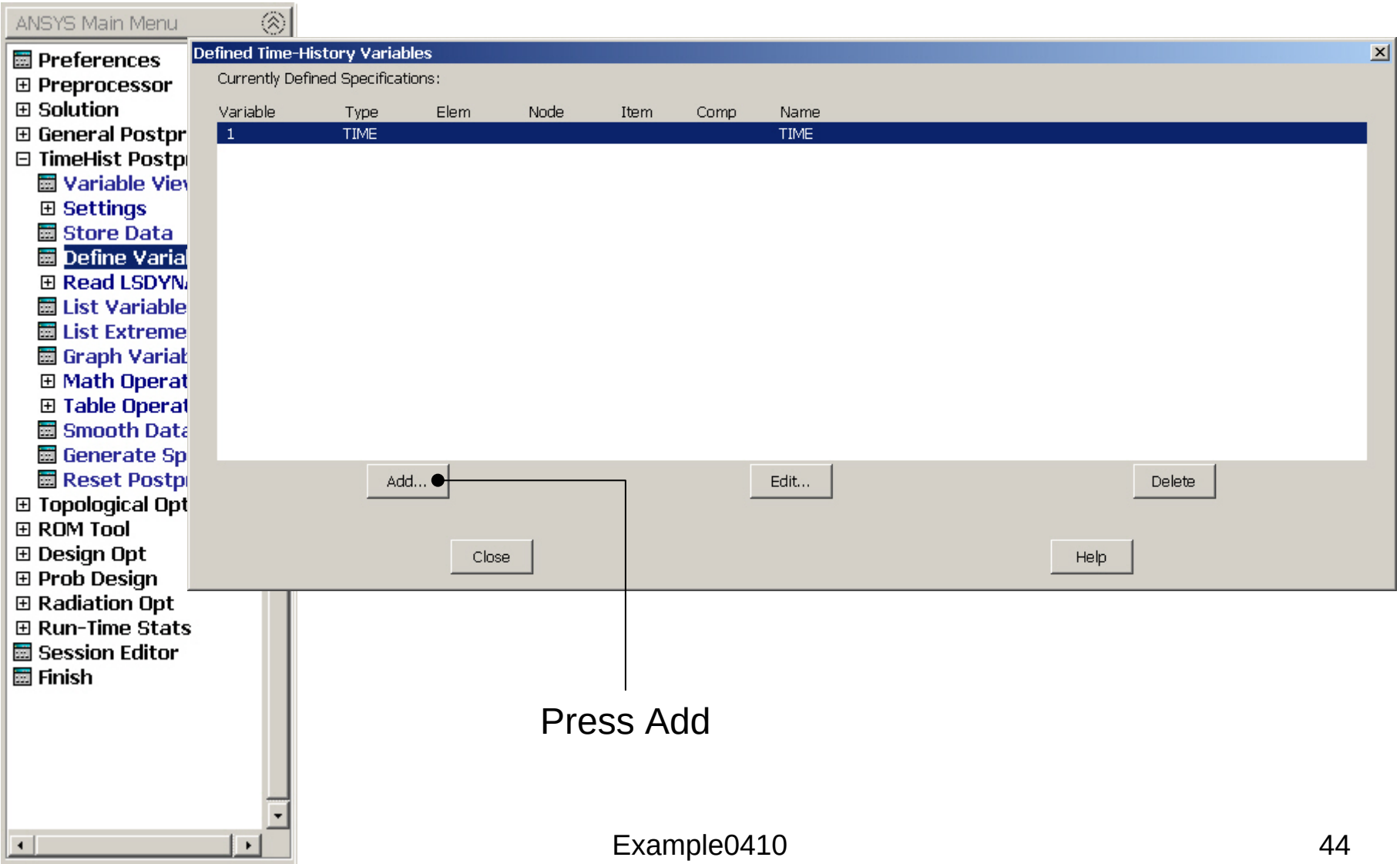
Example – TimeHistory Postpro





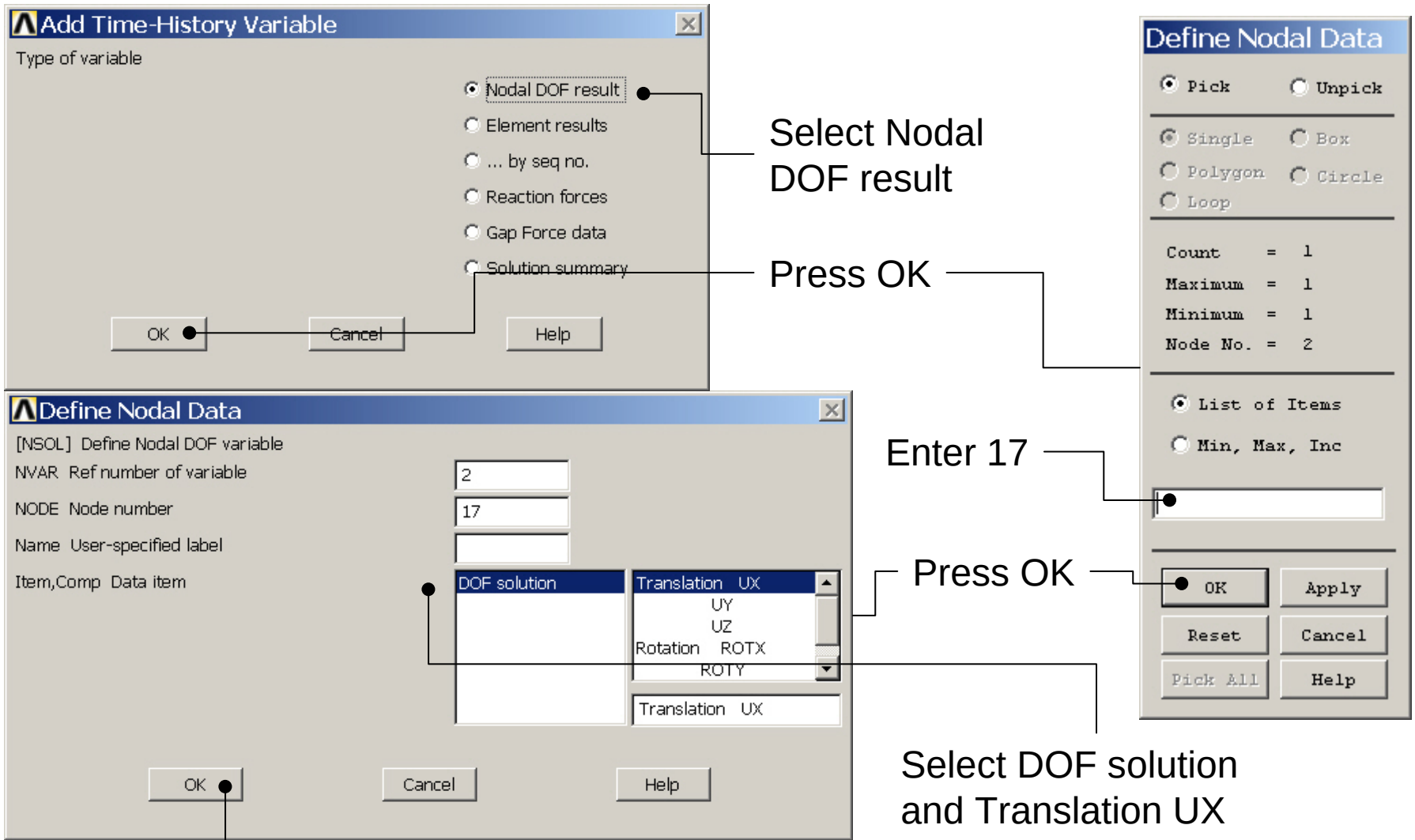
Close this dialog box

Example – Define Variables

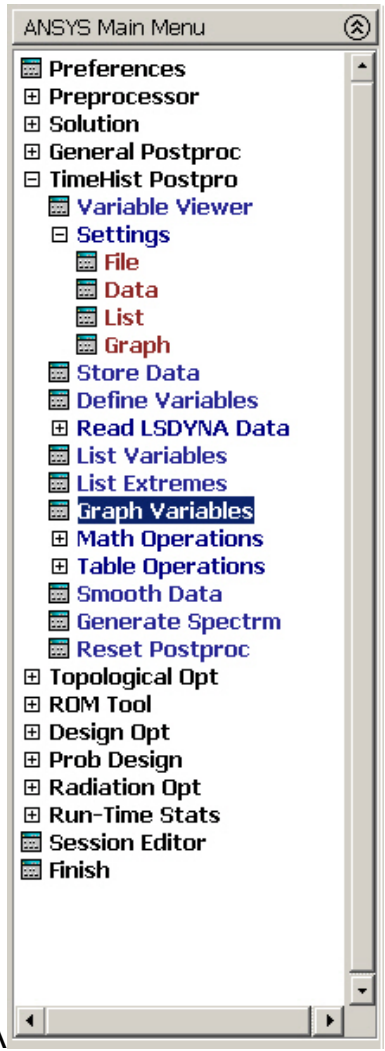


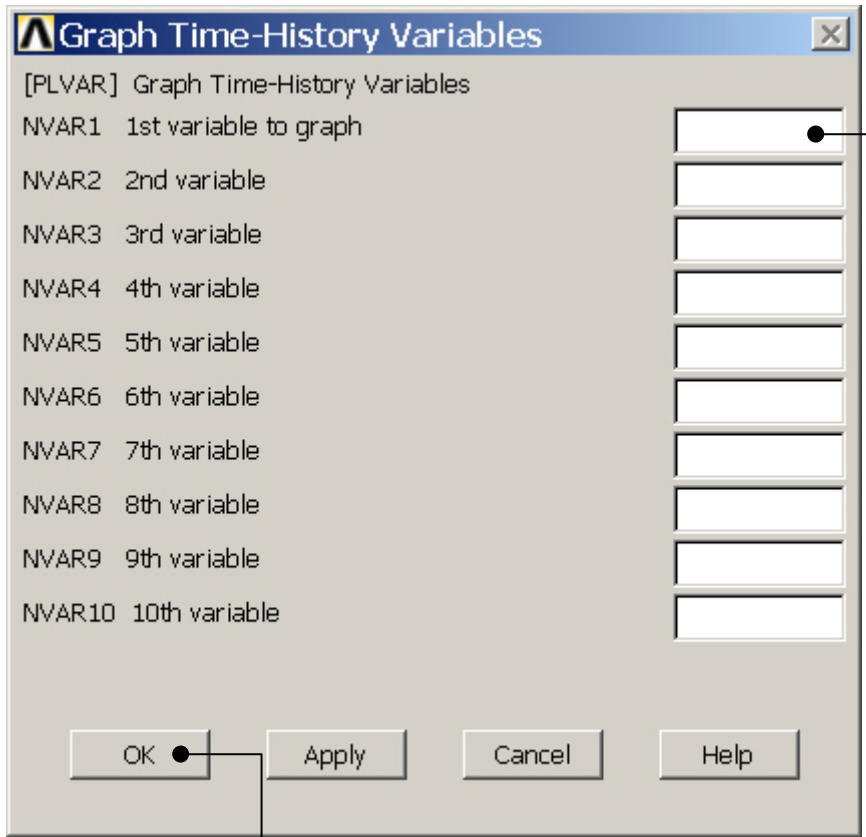
Press Add

Example – Add Time-History Var.



Example – Graph Variables





Enter 2 to plot UX for node 17

Press OK

Example – Graph Variables