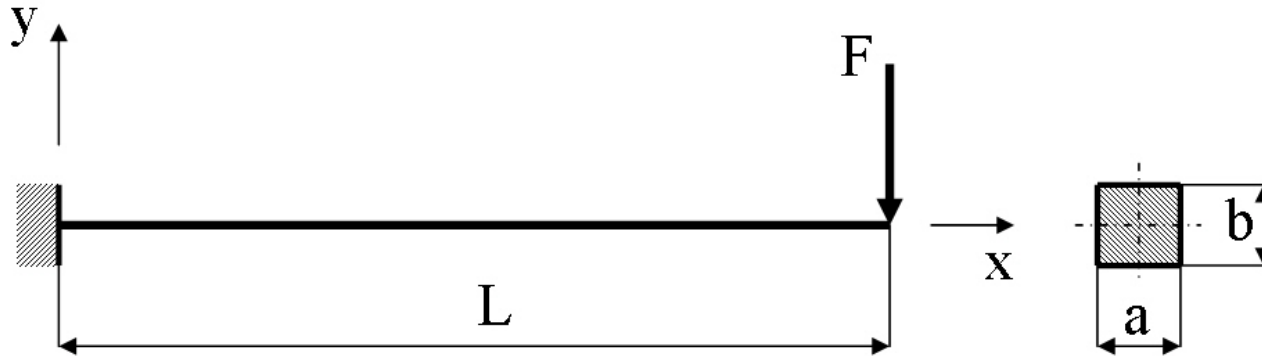


Course in ANSYS

Example0100

Example – Cantilever beam



Objective:

Compute the maximum deflection

Tasks:

Create a table and compare results
with results obtained from beam theory?
Display the deflection figure?

Topics:

Topics: Start of analysis, Element type,
Real constants, Material, modeling, ele-
ment size for beam models, saving/restoring

$$E = 210000 \text{ N/mm}^2$$

$$\nu = 0.3$$

$$L = 100 \text{ mm}$$

$$a = 10 \text{ mm}$$

$$b = 10 \text{ mm}$$

$$F = 100 \text{ N}$$

Modeling considerations

- As you begin your model generation, you will (consciously or unconsciously) make a number of decisions that determine how you will mathematically simulate the physical system:
 - What are the objectives of your analysis?
 - Will you model all, or just a portion, of the physical system?
 - How much detail will you include in your model?
 - What kinds of elements will you use? How dense should your finite element mesh be?
- In general, you will attempt to balance computational expense (CPU time, etc.) against precision of results as you answer these questions.
- The decisions you make in the planning stage of your analysis will largely govern the success or failure of your analysis efforts.

Modeling considerations

- Linear or Higher Order Elements
- Take Advantage of Symmetry
 - The axis of symmetry *must* coincide with the global Cartesian Y-axis.
 - Negative nodal X-coordinates are not permitted.
 - The global Cartesian Y-direction represents the axial direction, the global Cartesian X-direction represents the radial direction, and the global Cartesian Z-direction corresponds to the circumferential direction.
 - Your model should be assembled using appropriate element types:
 - For axisymmetric models, use applicable 2-D solids with KEYOPT(3) = 1, and/or axisymmetric shells. In addition, various link, contact, combination, and surface elements can be included in a model that also contains axisymmetric solids or shells. (The program will not realize that these "other" elements are axisymmetric unless axisymmetric solids or shells are present.)
- How Much Detail to Include
- Appropriate Mesh Density

Example - title

Utility Menu > File > Change Jobname

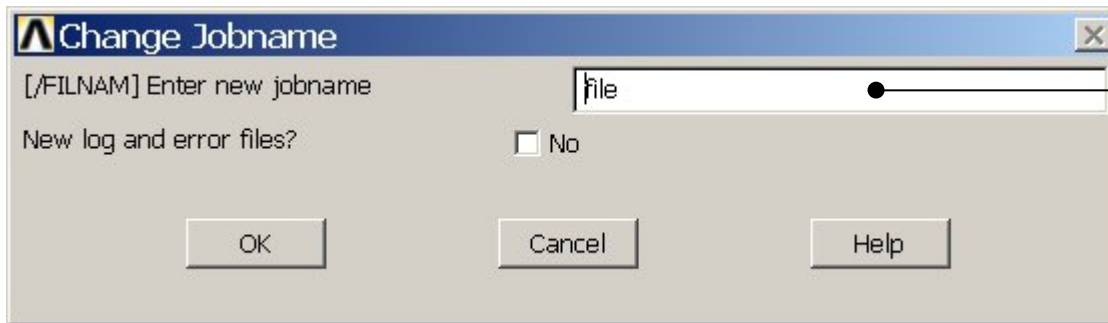


GUI

/jobname, Example0100



Command line entry

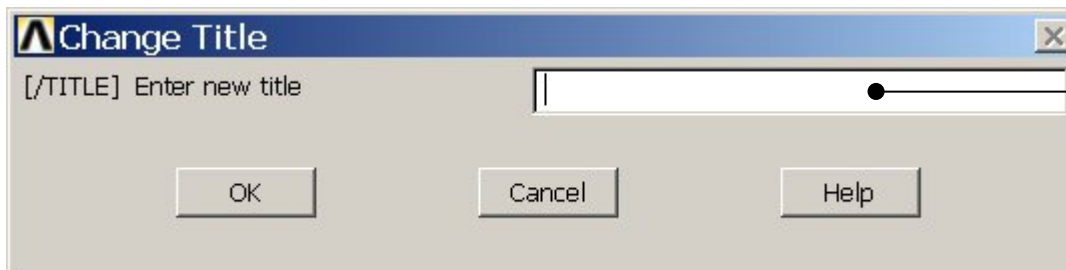


Enter: Example0100

Utility Menu > File > Change Title

/title, Cantilever beam

Enter: Cantilever beam



Example - Keypoints

Note: An empty # result in automatic numbering.

Preprocessor > Modeling > Create > Keypoints > In Active CS

/PREP7

K,,,,

K,,100,,

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

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

ANSYS Create Keypoints in Active Coordinate System

[K] Create Keypoints in Active Coordinate System

NPT Keypoint number

X,Y,Z Location in active CS

OK Apply Cancel Help

Press **Apply**

ANSYS Create Keypoints in Active Coordinate System

[K] Create Keypoints in Active Coordinate System

NPT Keypoint number

X,Y,Z Location in active CS

OK Apply Cancel Help

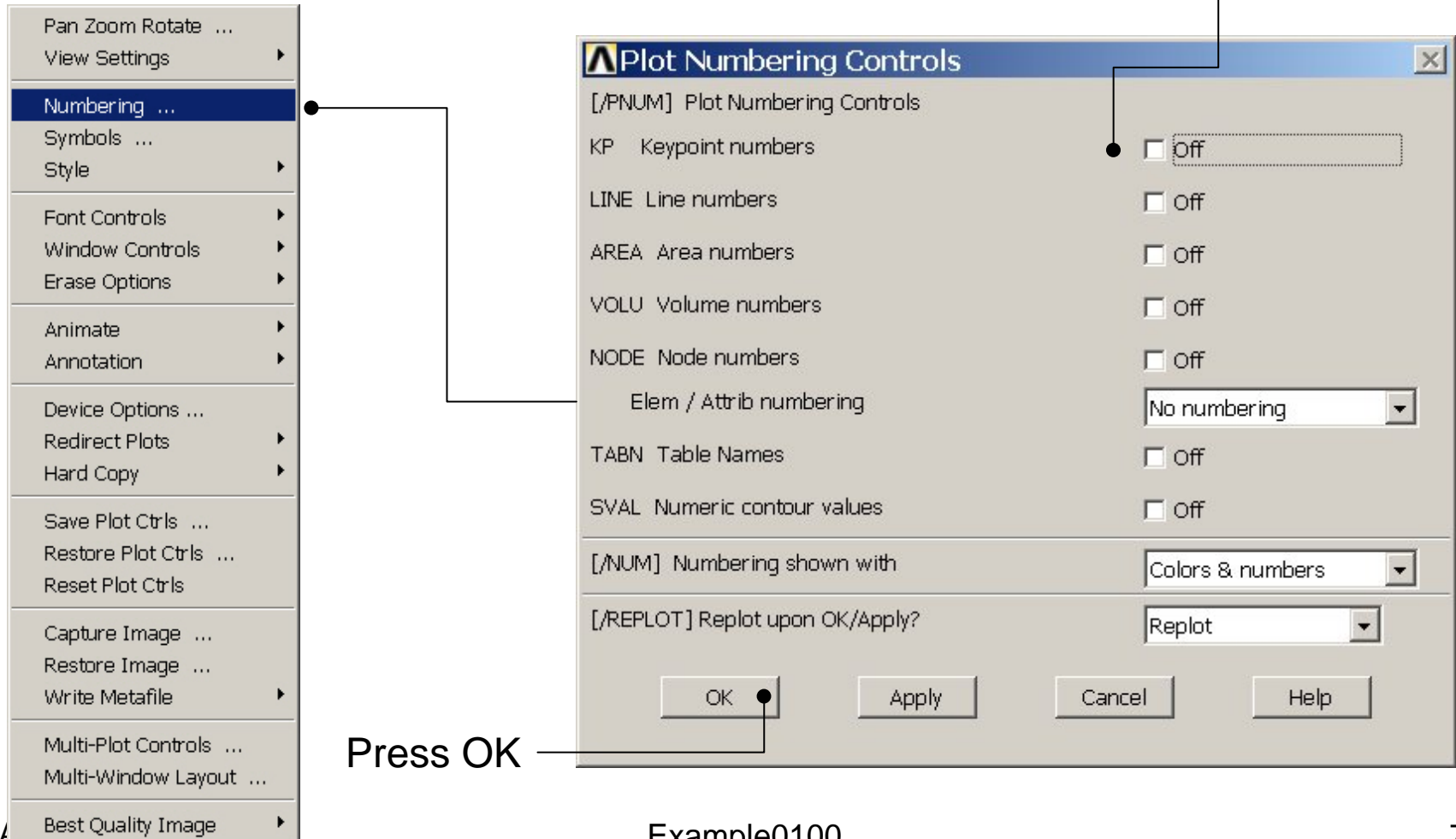
Enter 100 and Press **Apply**

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

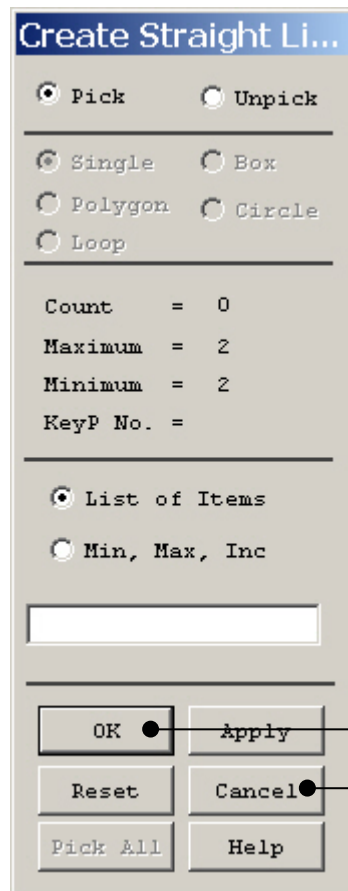


Example - Lines

Preprocessor > Modeling > Create > Lines > Lines > Straight Line

Create a line between Keypoint KP1 and Keypoint KP2.

L,1,2



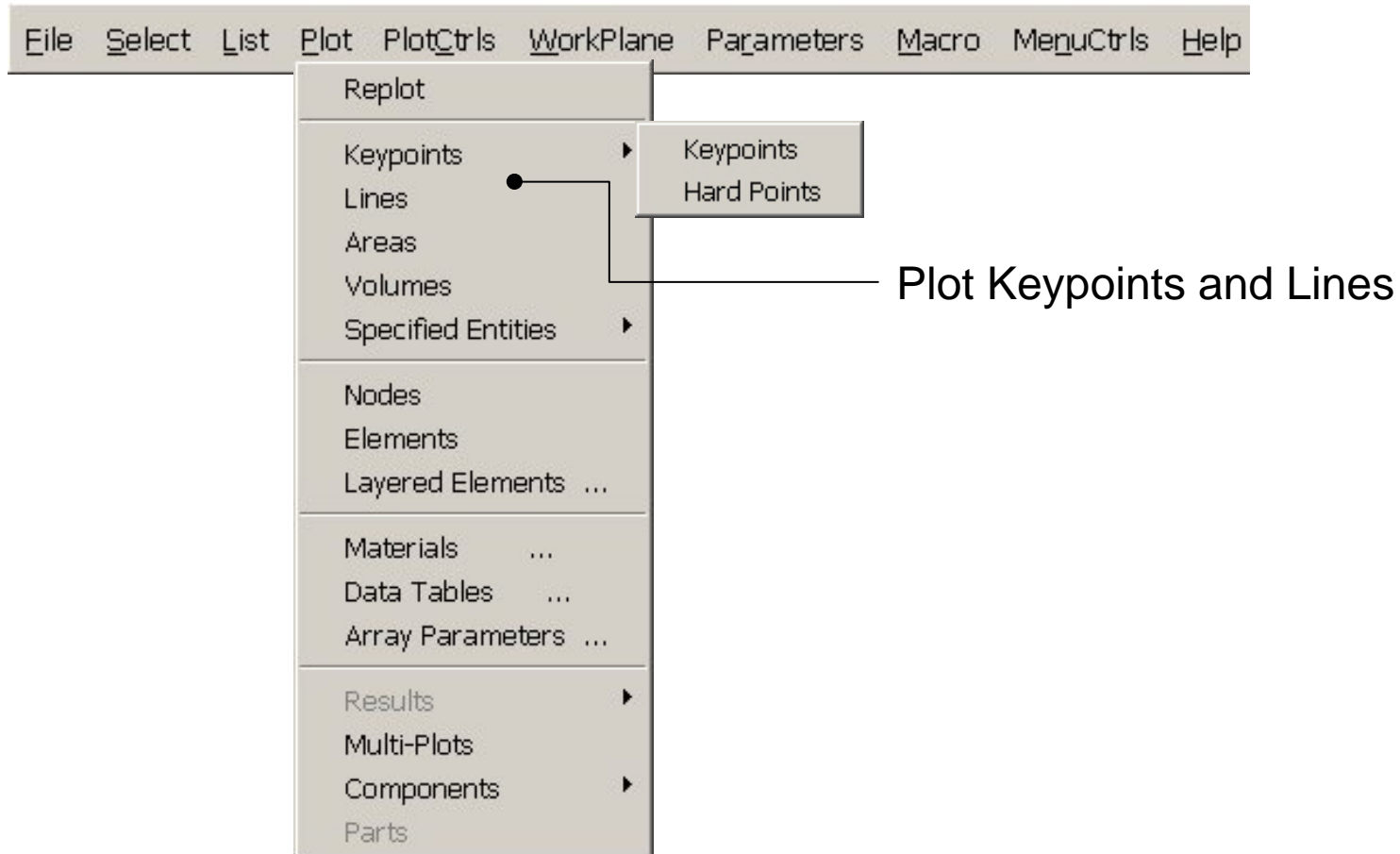
HINT: By clicking with the right-hand mouse button you shift between the Pick/Unpick function. This is indicated by the direction of the cursor arrow:

Pick: upward arrow

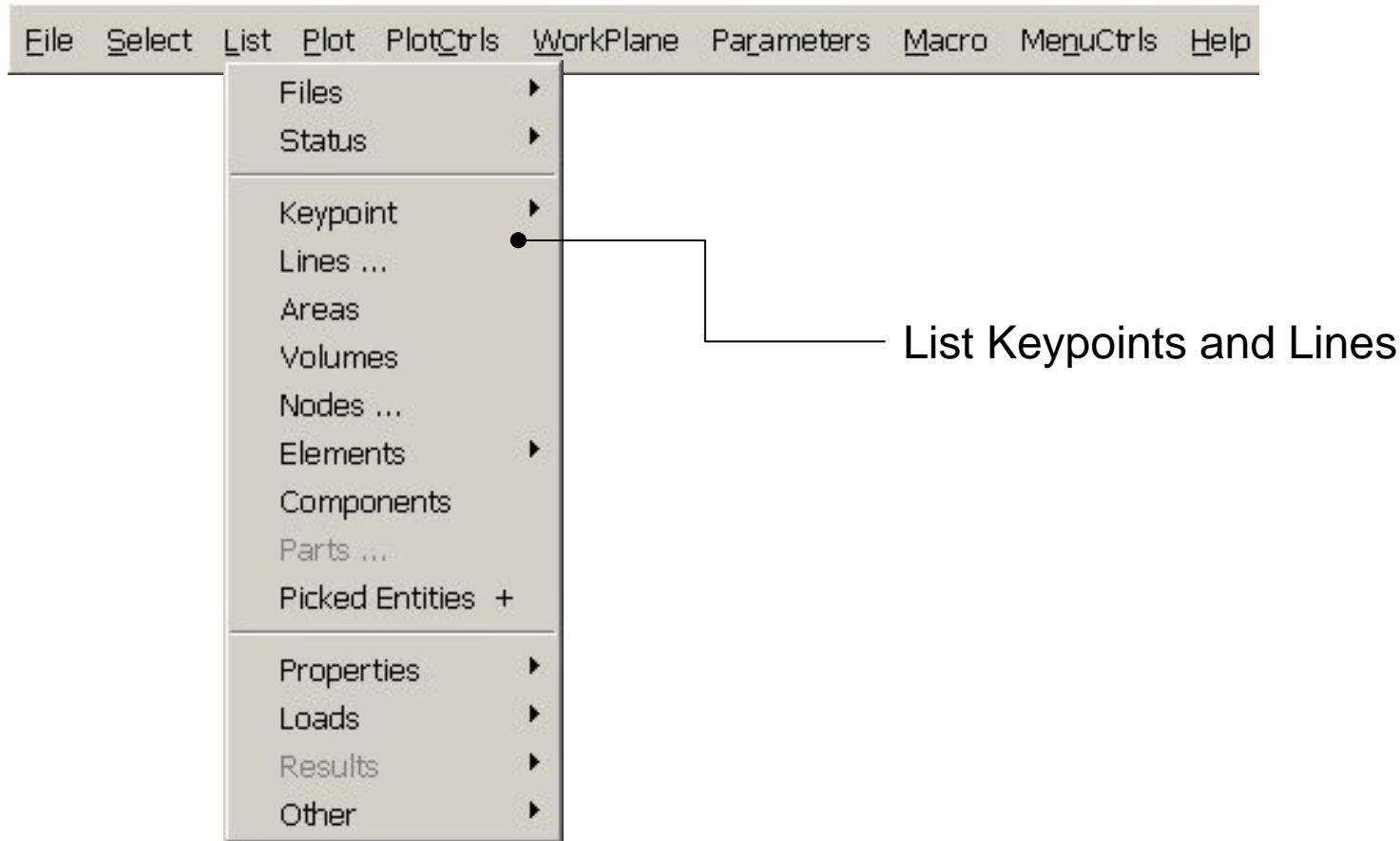
Unpick: downward arrow

Press OK or Cancel to finish selection

Example - Plot

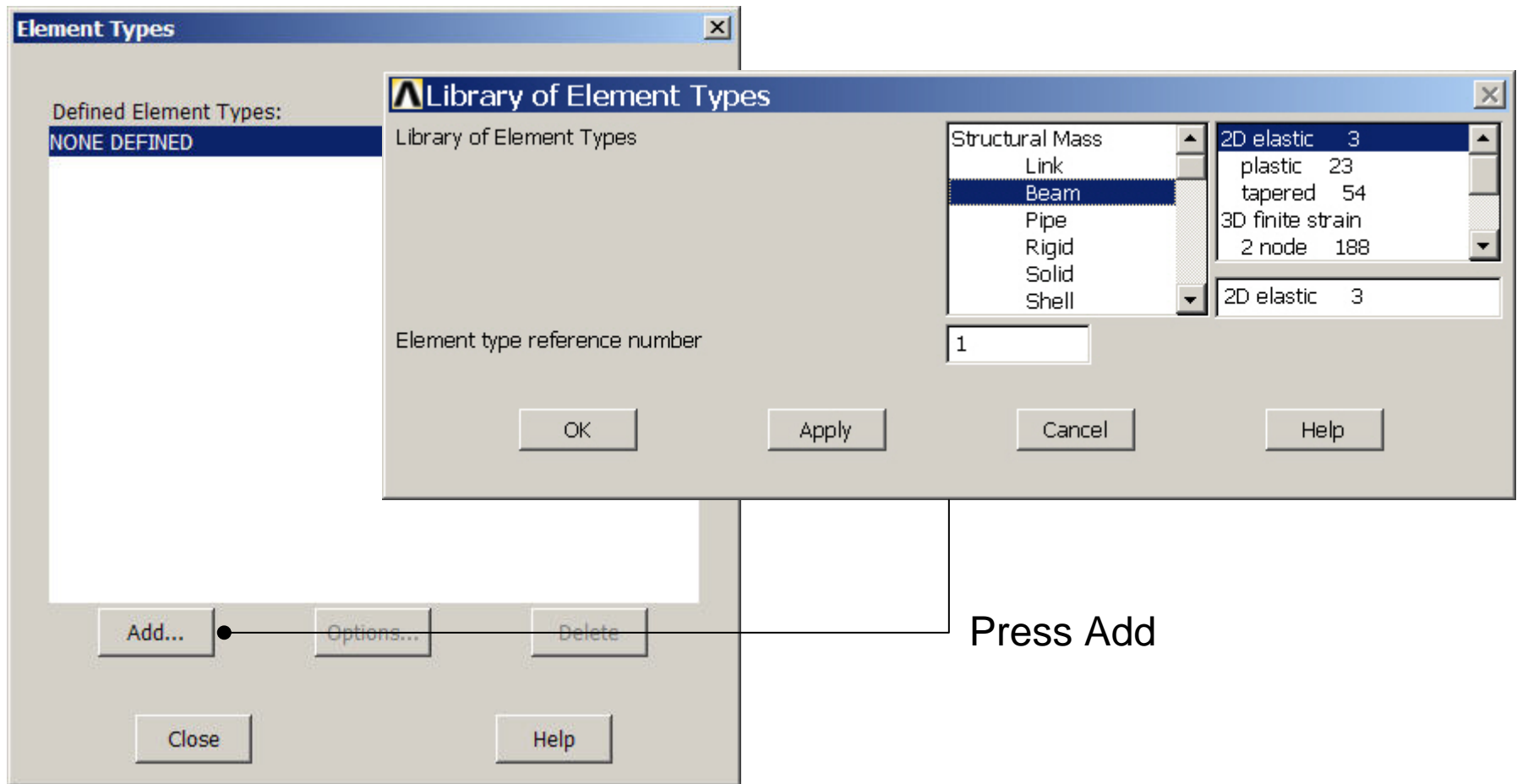


Example - List



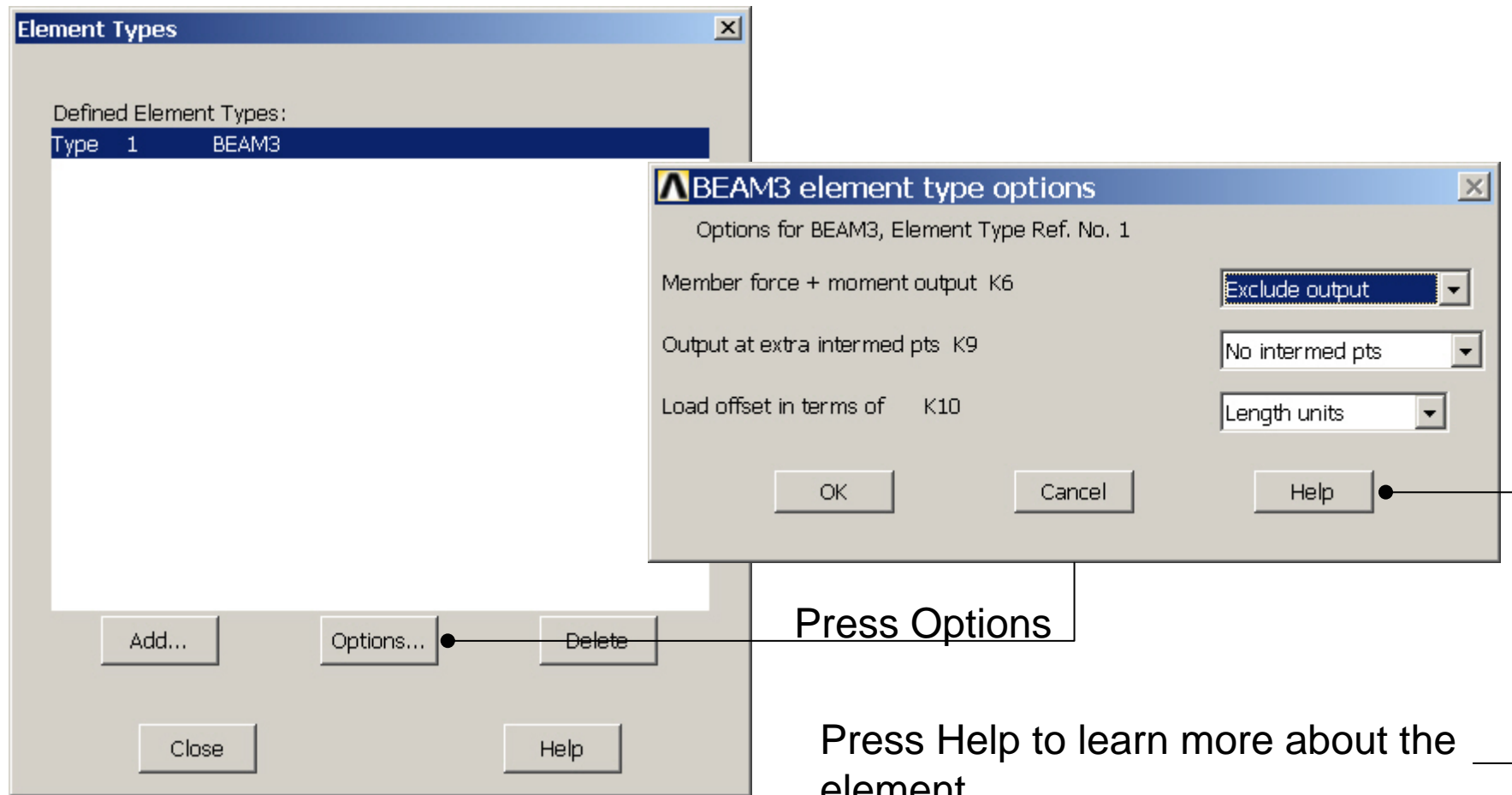
Example – Element Type

Preprocessor > Element Type > Add/Edit/Delete



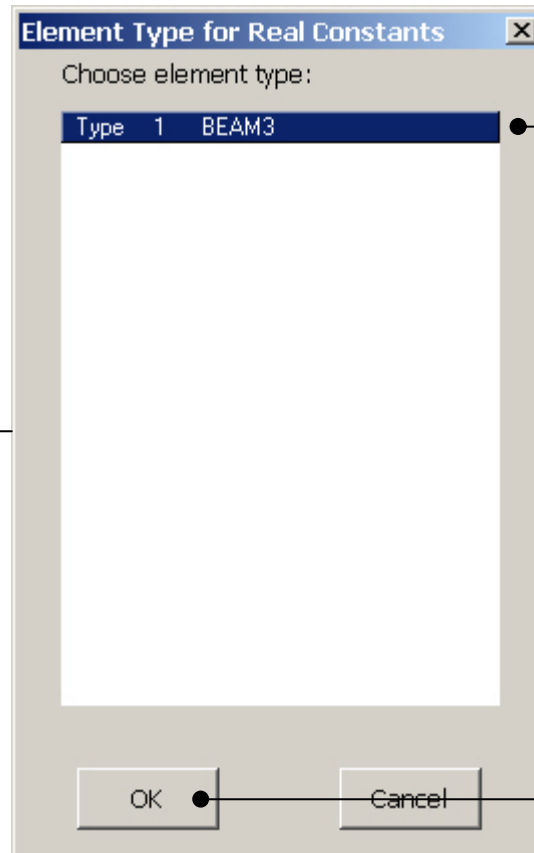
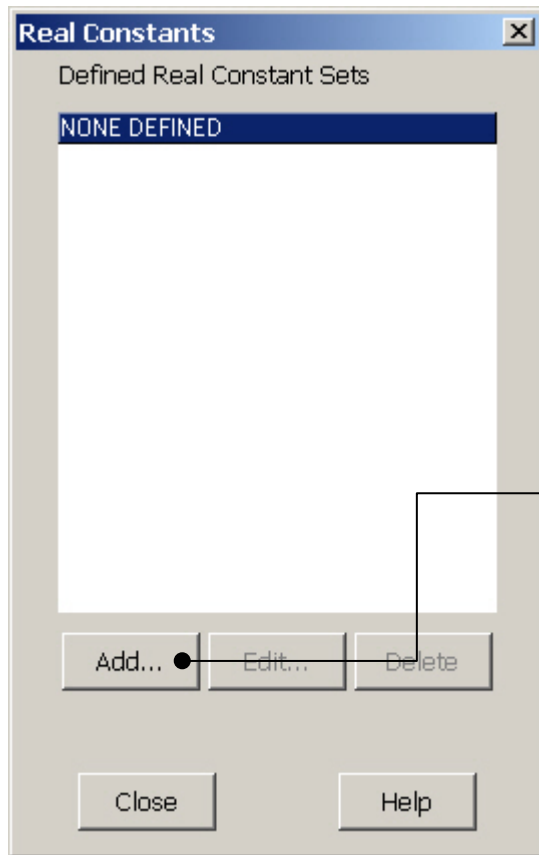
Example - Element Type

Preprocessor > Element Type > Add/Edit/Delete



Example – Real Constants

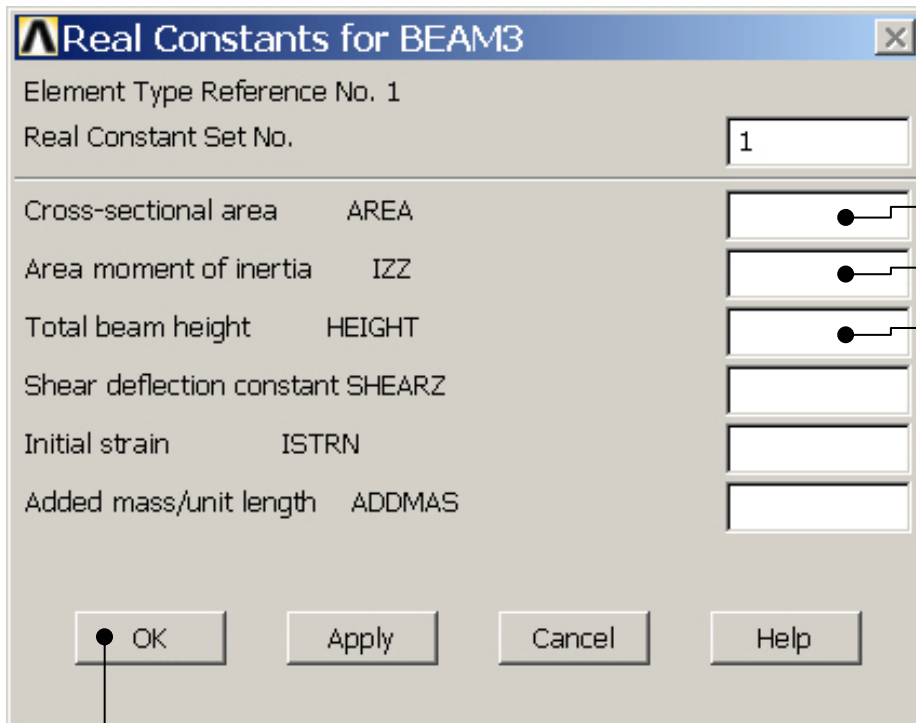
Preprocessor > Real Constants > Add



Place the cursor on the relevant element and press OK

Example - Real Constants

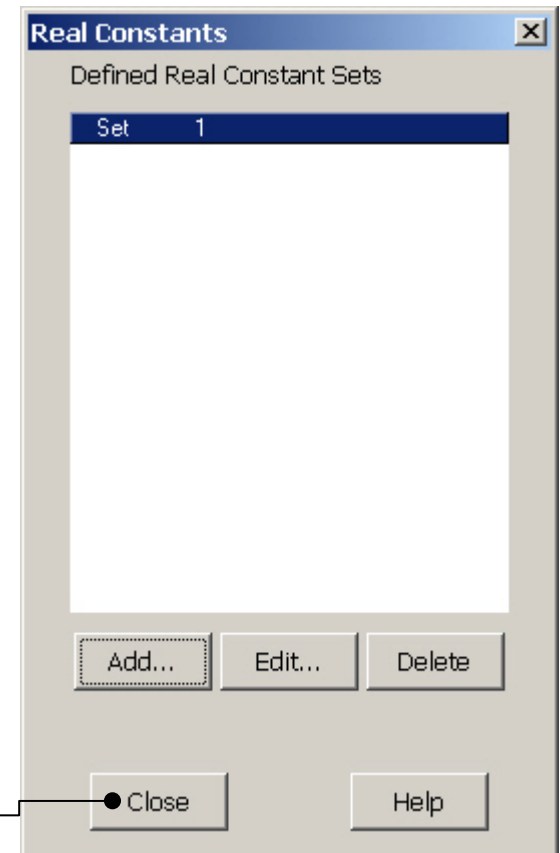
Preprocessor > Real Constants > Add



Enter 100
Enter 833.3
Enter 10

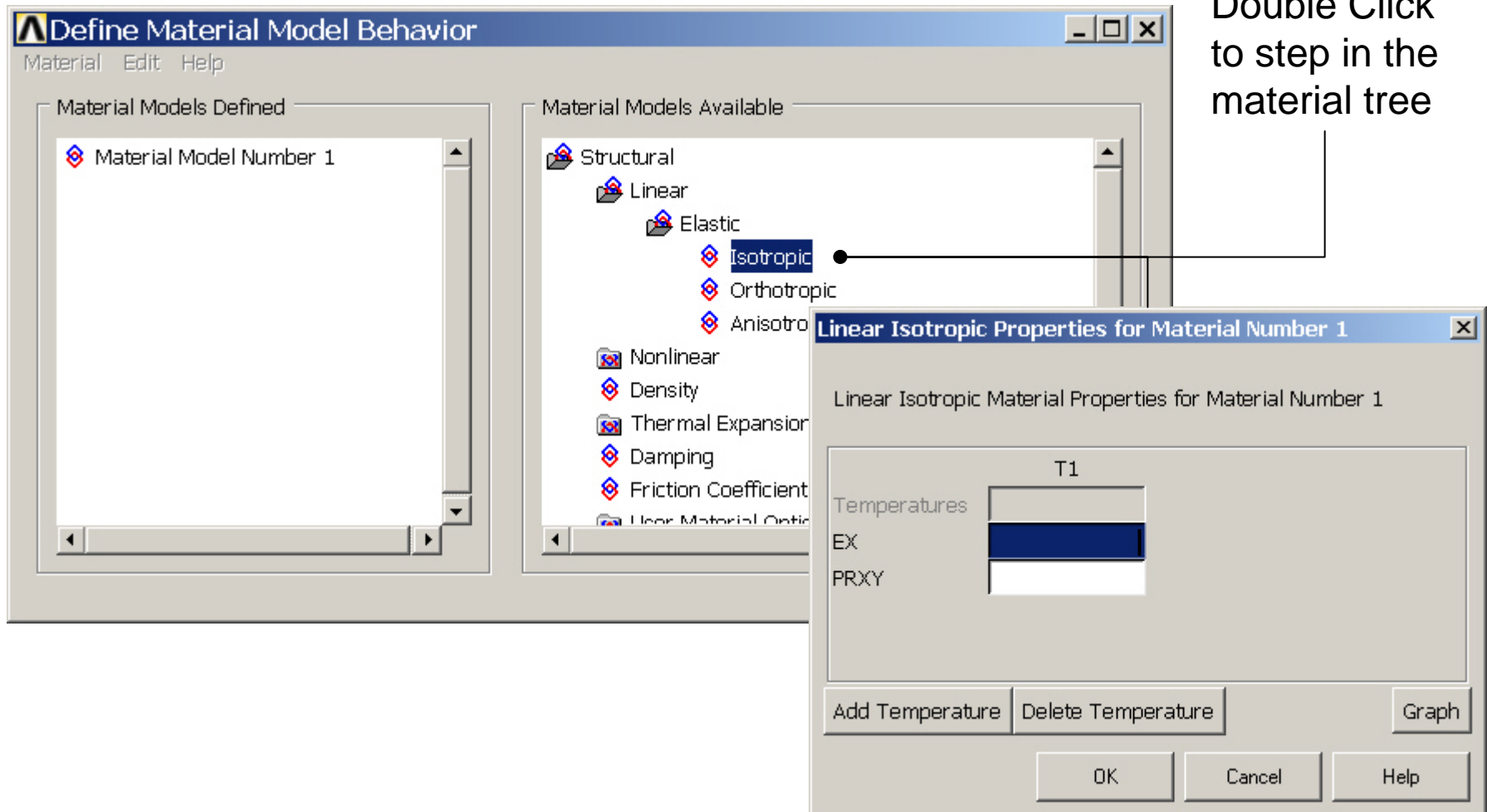
Press OK

Press Close
to finish



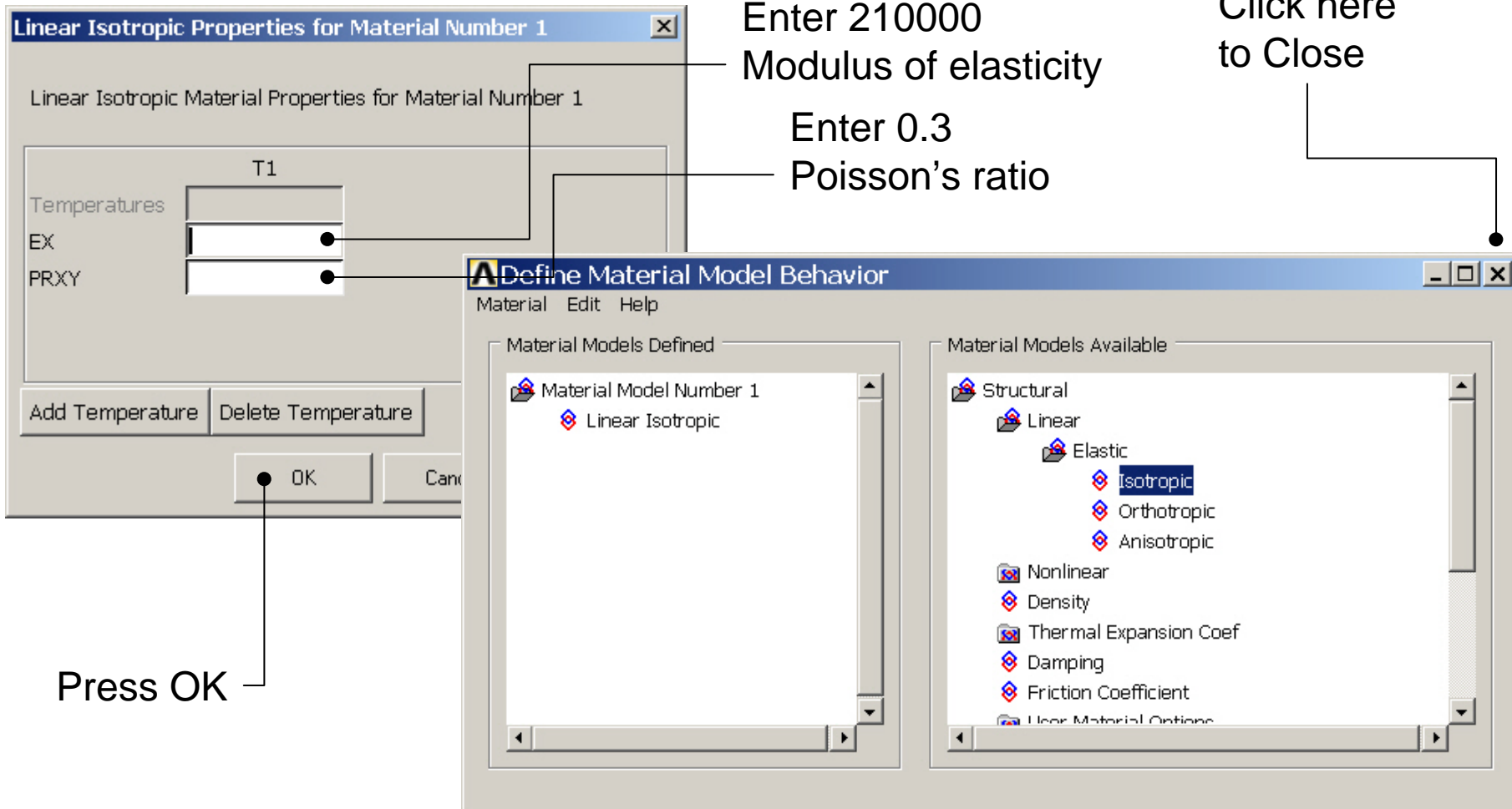
Example - Material Properties

Preprocessor > Material Props > Material Models



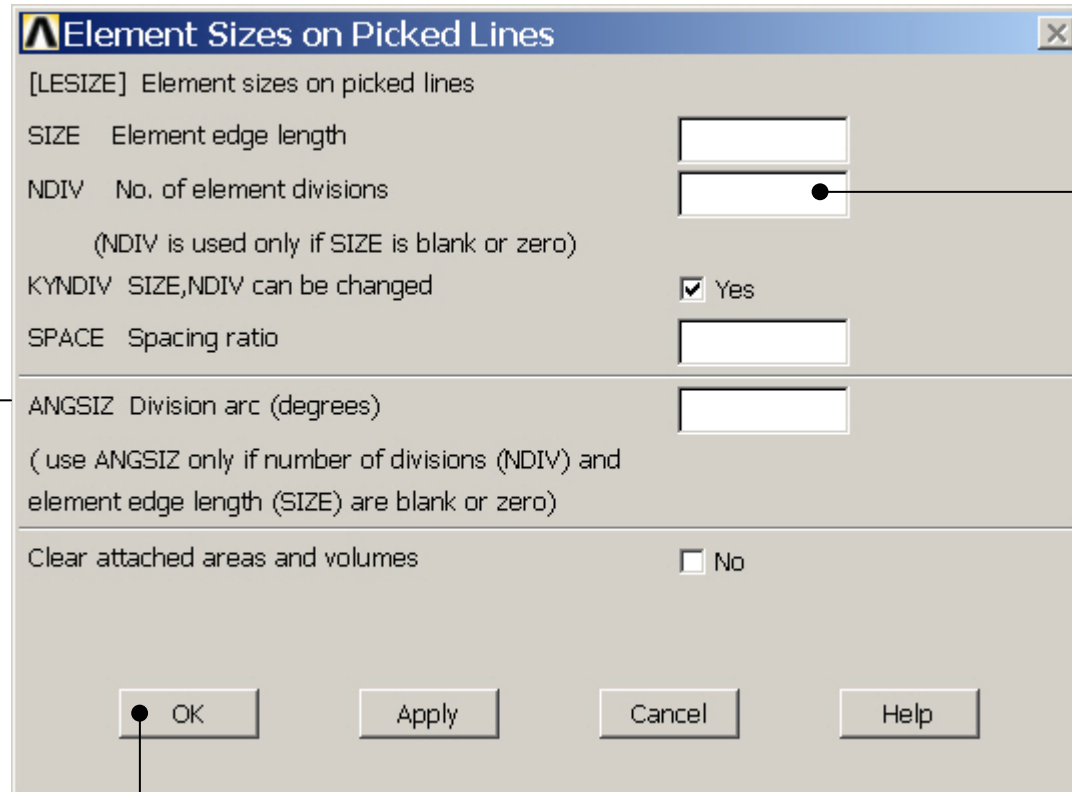
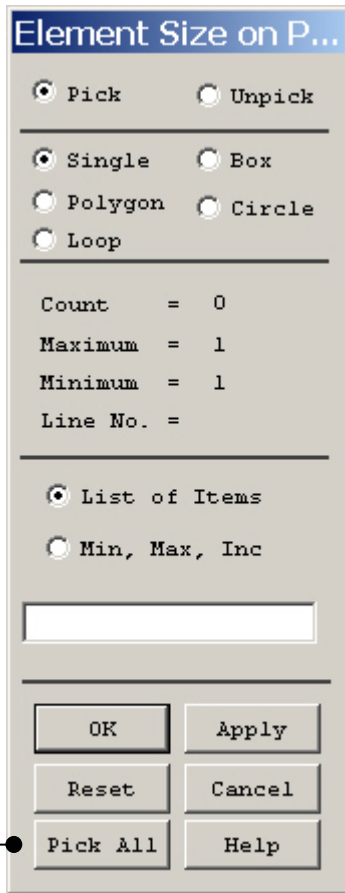
Example - Material Properties

Preprocessor > Material Props > Material Models



Example – Mesh size

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



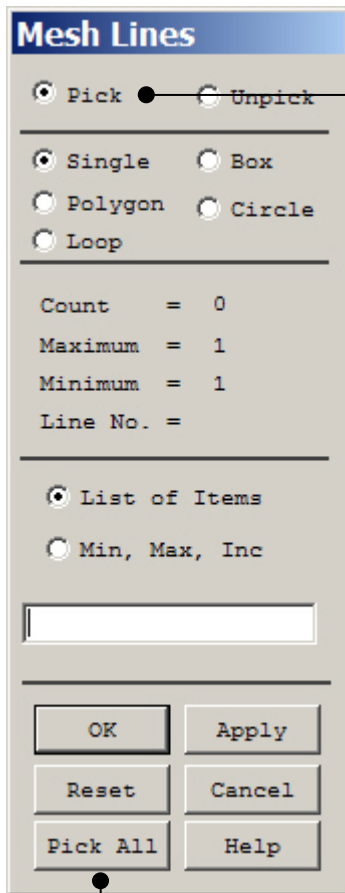
Enter 1

Press OK

Select Pick All

Example - Meshing

Preprocessor > Meshing > Mesh > Lines



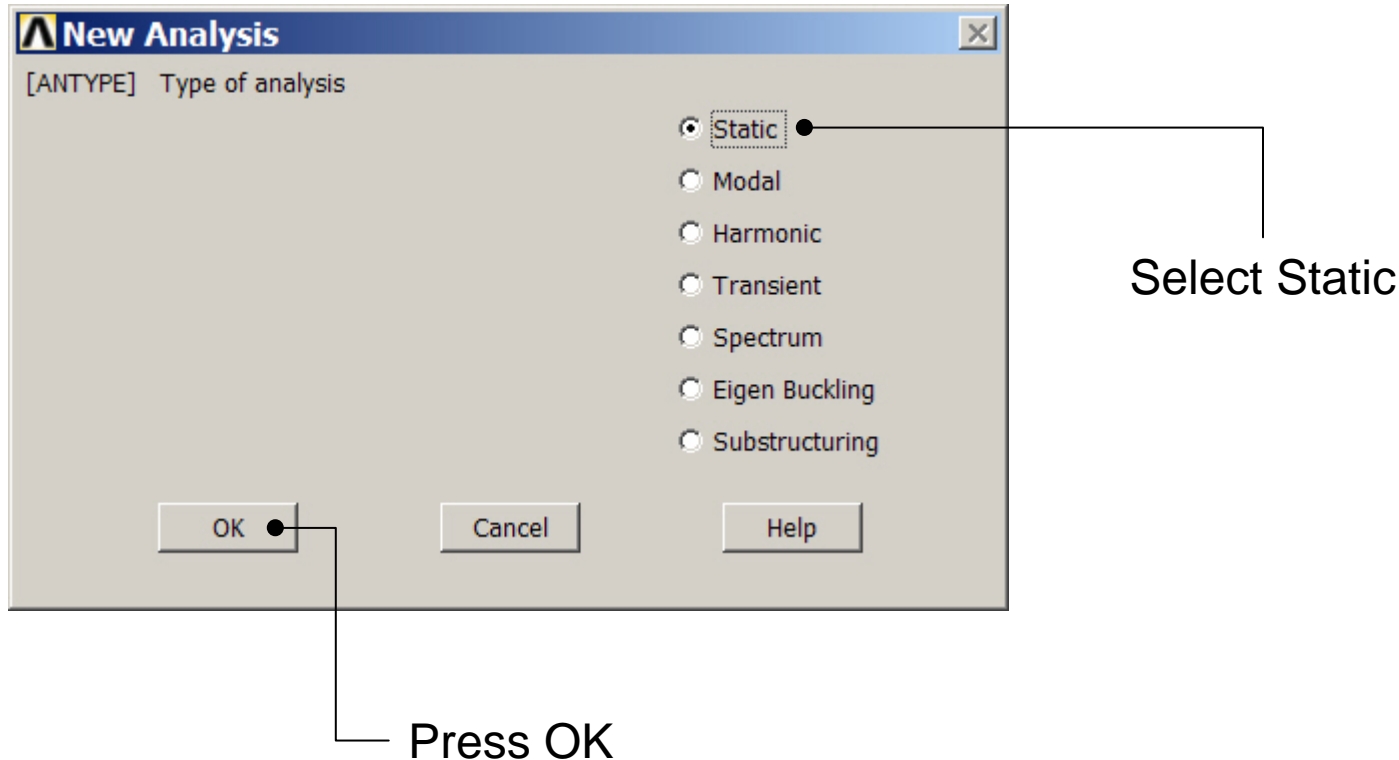
Select individual lines to be meshed by Picking

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

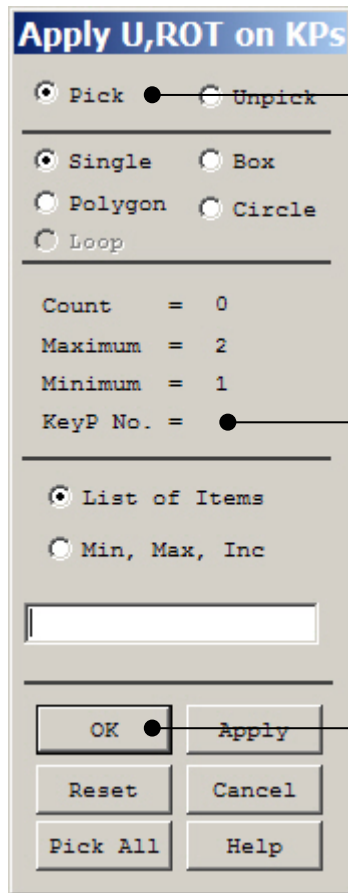
Example – Analysis Type

Solution > Analysis Type > New Analysis



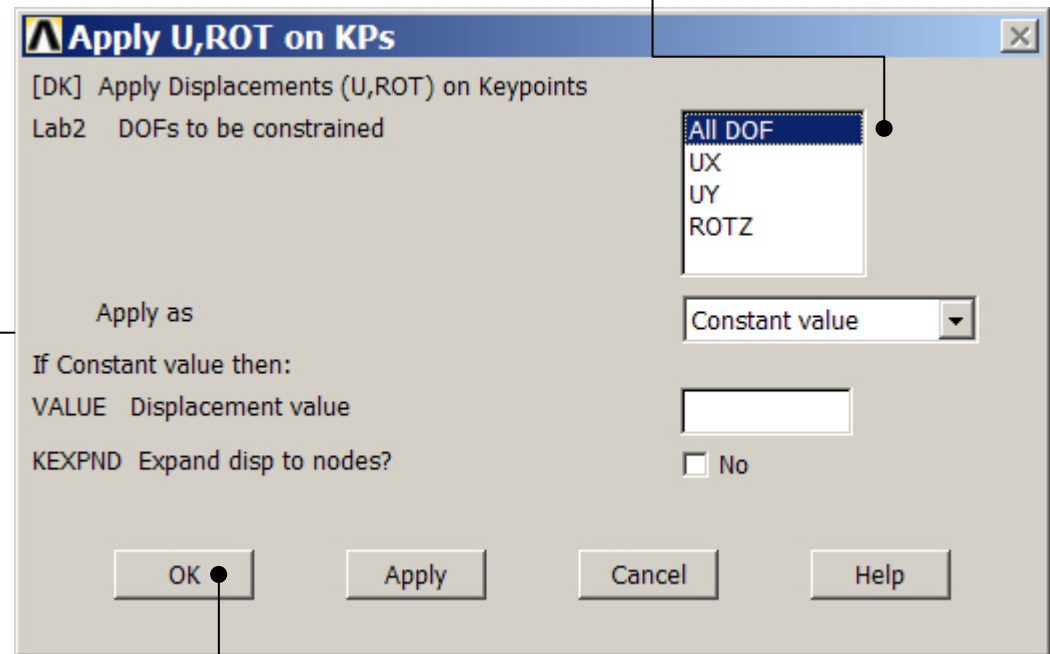
Example – Define Loads

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



Select keypoint KP1

Select All DOF to fix/clamp the beam



Apply as

If Constant value then:

VALUE Displacement value

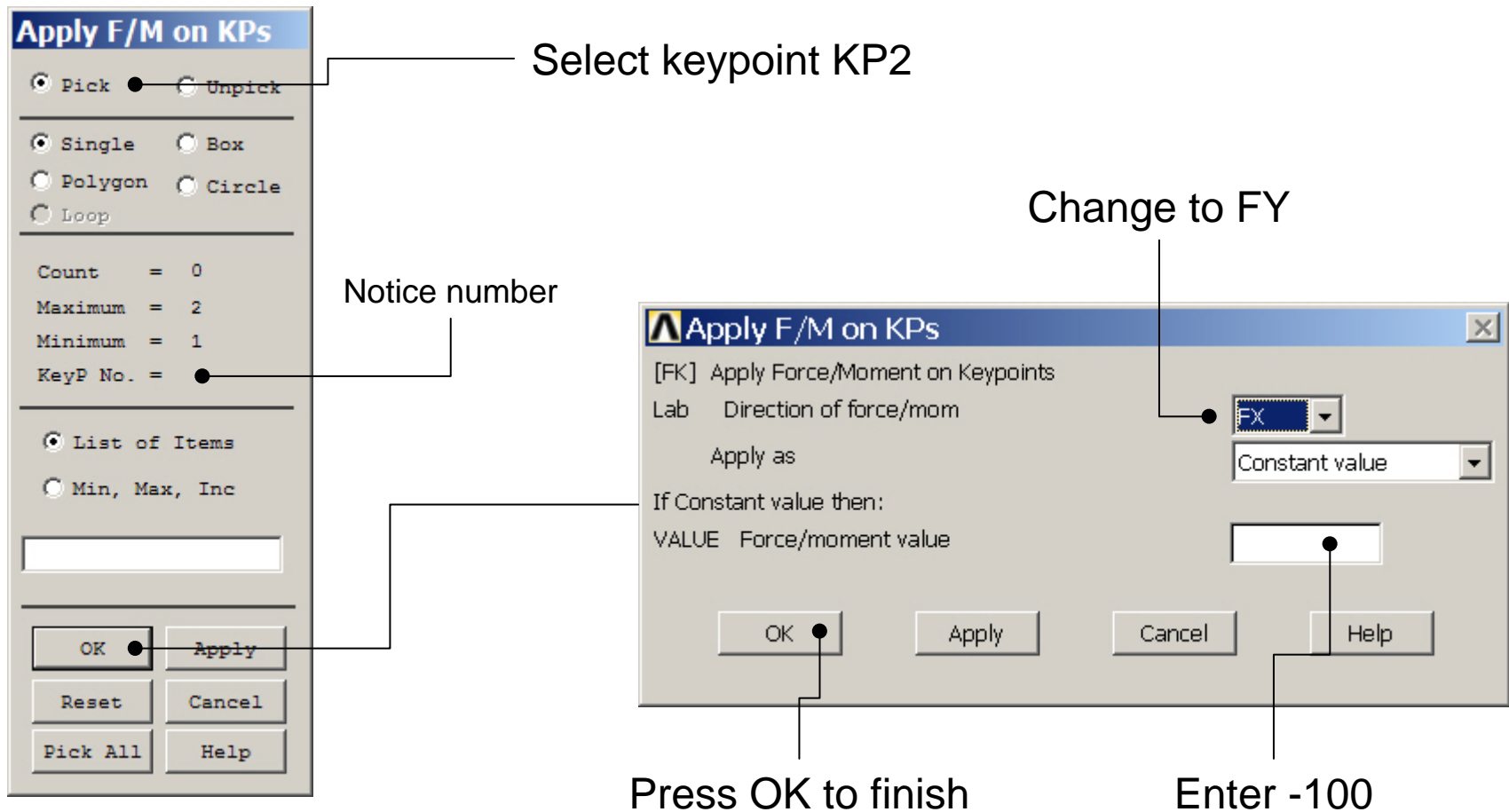
KEXPND Expand disp to nodes?

☐ No

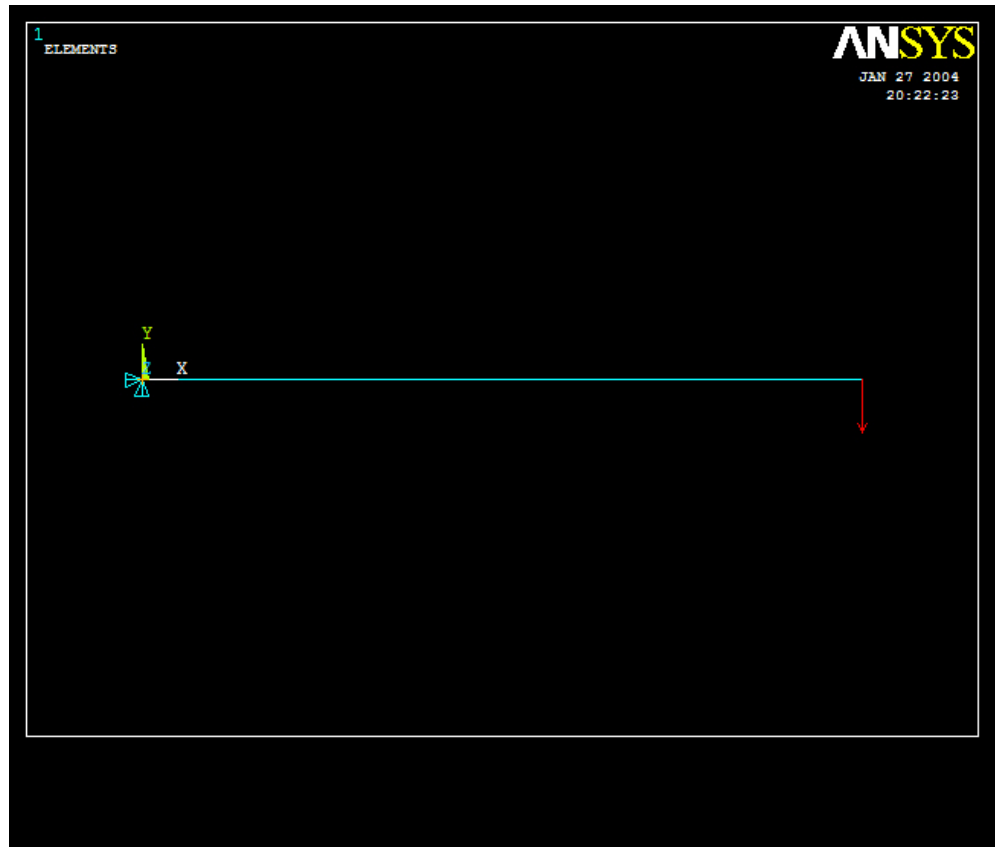
Press OK

Example – Define Loads

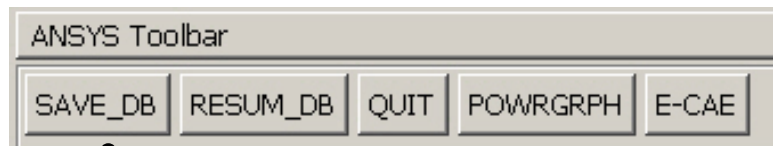
Solution > Define Loads > Apply > Structural > Force/Moment > On Keypoints



Example - Save



Display of Analysis model

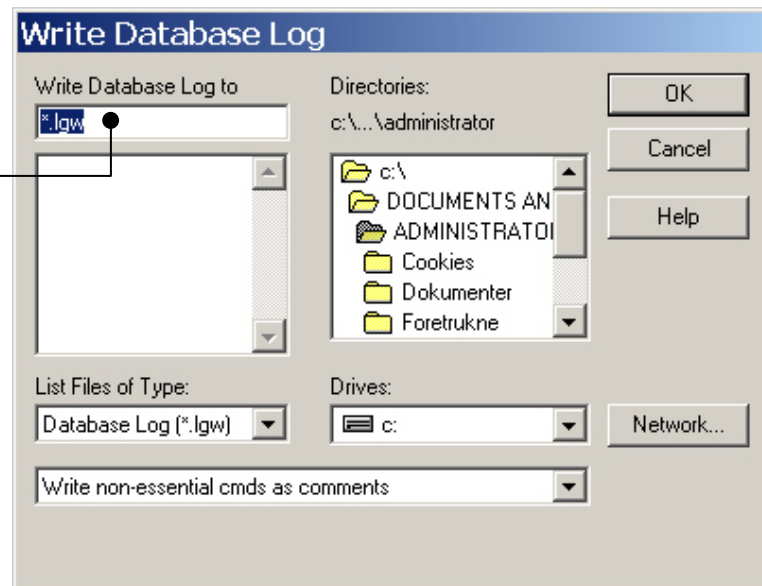


Save the model

Example – Write DB log file

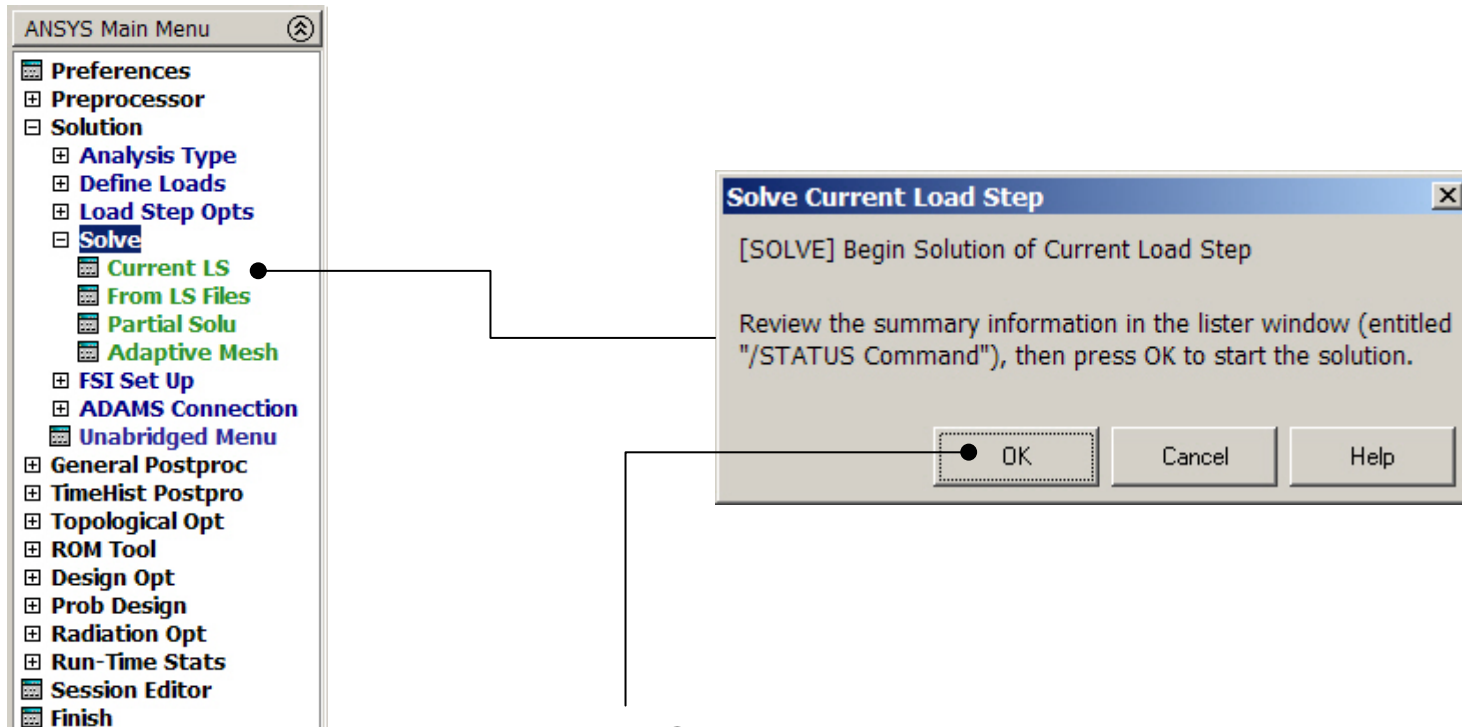
File > Write DB log file

Enter “example0100.lgw”



Example – Solve LS

Solution > Solve > Current LS



Press OK

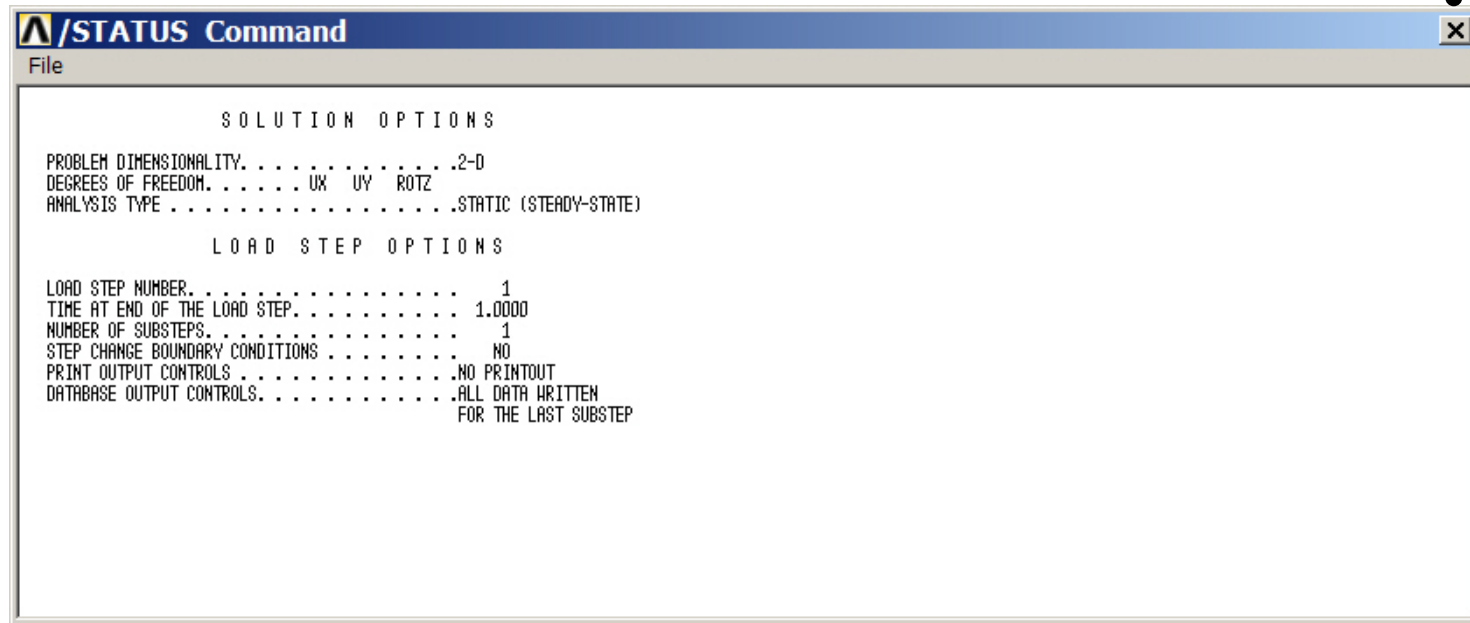
Example0100

Example – Solution Status



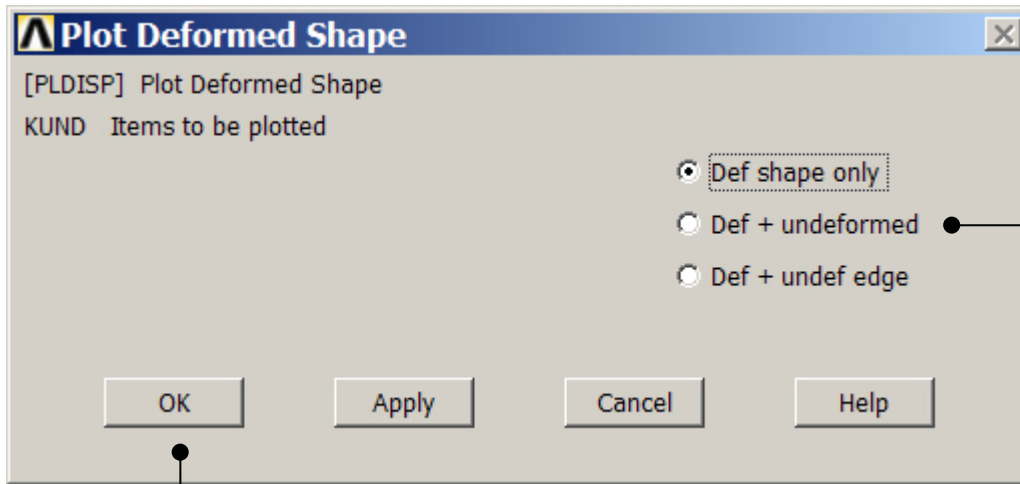
Press Close

Press here
to Close



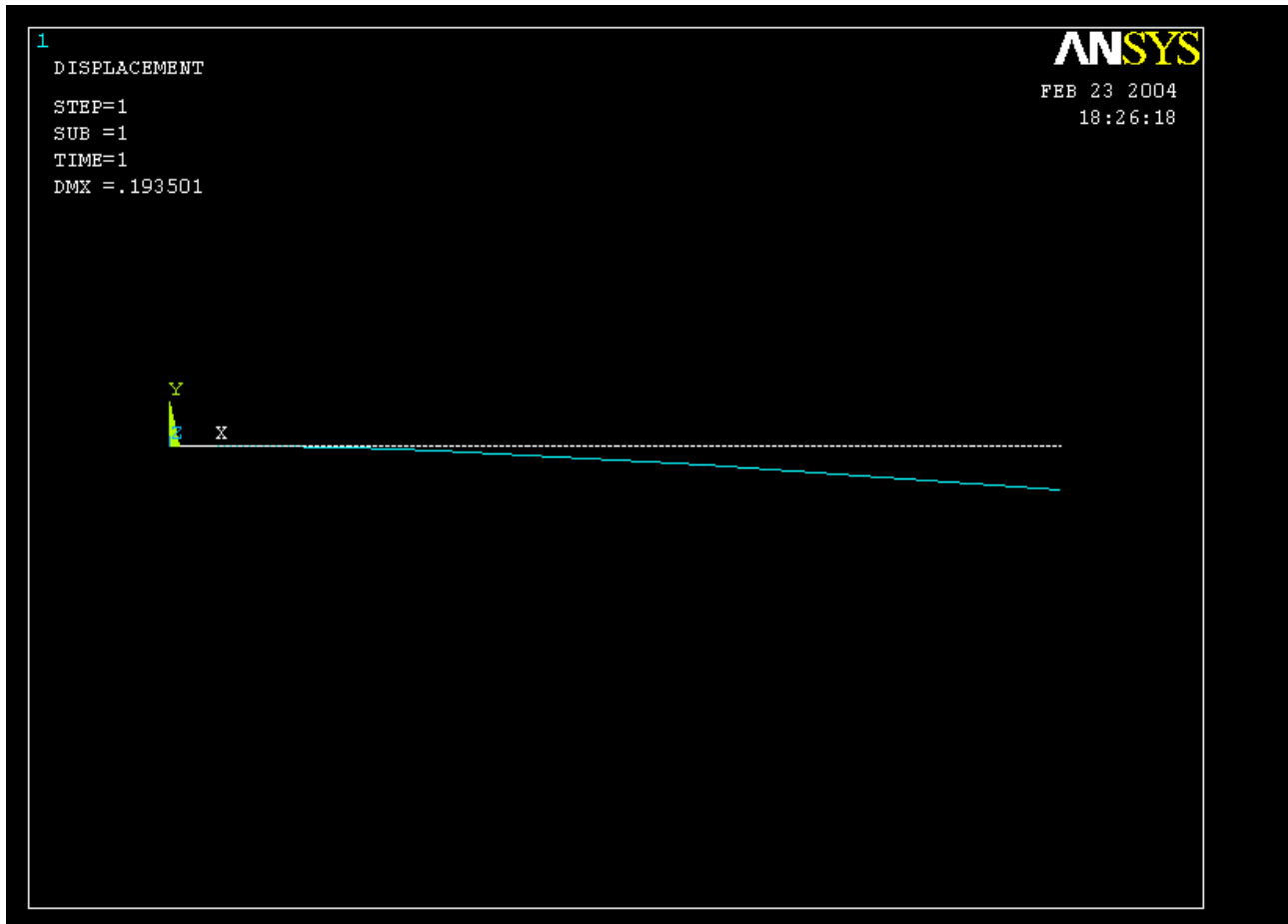
Example - PostProcessing

General Postproc > Plot Results > Deformed Shape



Select "Def+undeformed"
and Press OK

Example - PostProcessing

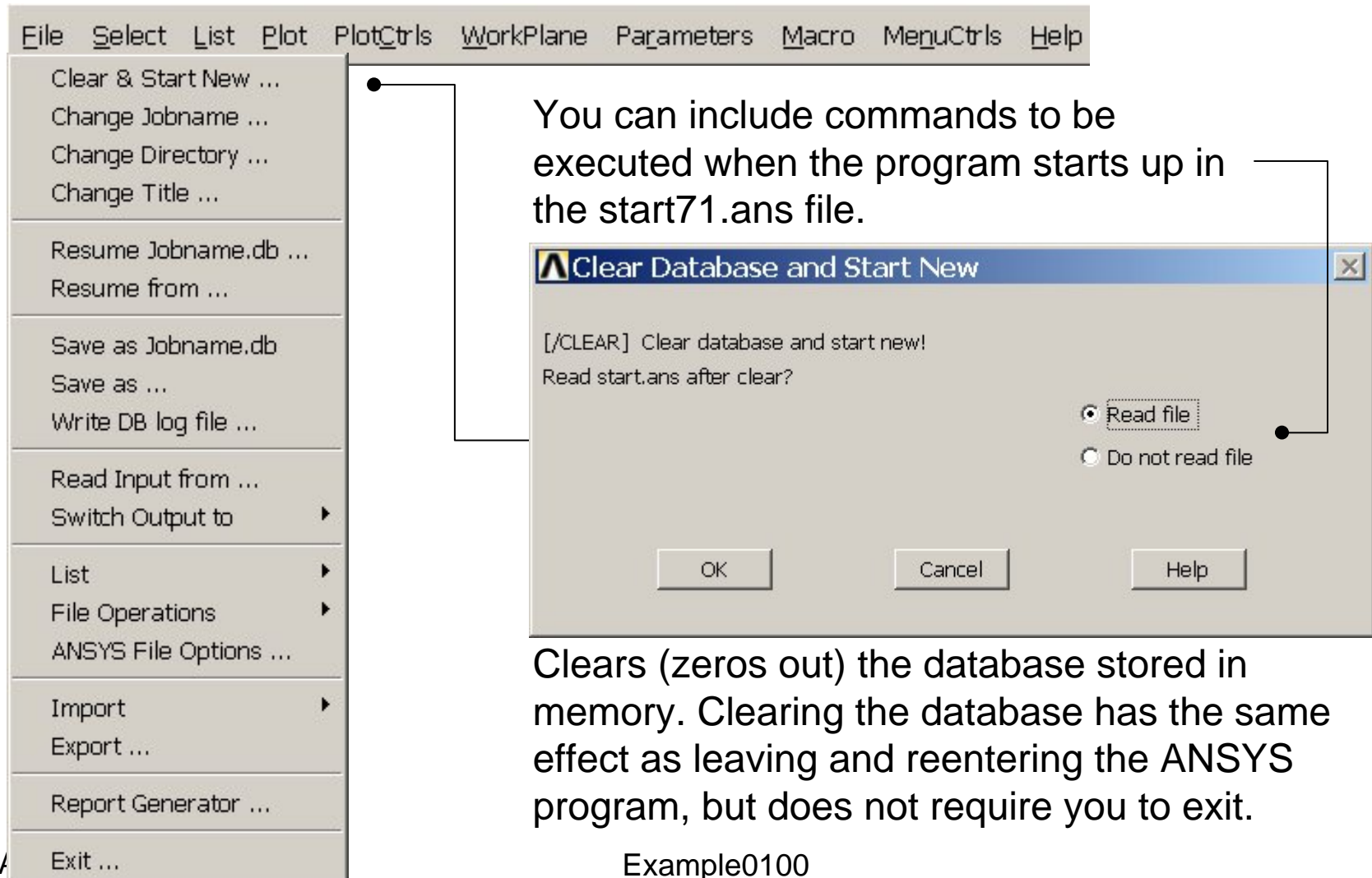


Read Maximum displacement: DMX

The scaling of displacement can be adjusted by

Utility Menu> PlotCtrls> Style> Displacement Scaling

Example – Clear & Start New



Example0100

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Example – Comments/Questions

- Why is it relevant to consider a Beam model in many cases?
- The “example0100.lgw” can be edited in “Notepad”
- What are the assumptions in beam theory?
- Will the number of elements affect the solution?