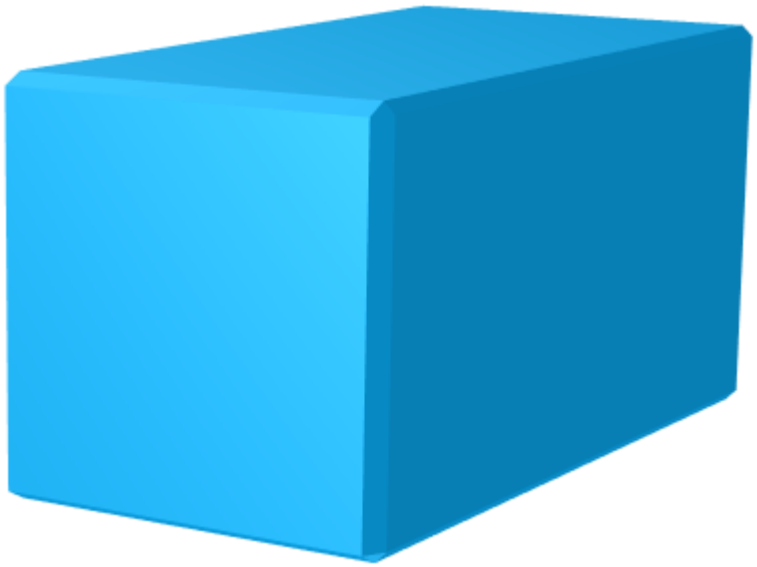
Using P-Elements

Introduction

This tutorial was completed using ANSYS 7.0. This tutorial outlines the steps necessary for solving a model meshed with p-elements. The p-method manipulates the polynomial level (p-level) of the finite element shape functions which are used to approximate the real solution. Thus, rather than increasing mesh density, the p-level can be increased to give a similar result. By keeping mesh density rather coarse, computational time can be kept to a minimum. This is the greatest advantage of using p-elements over h-elements.

A uniform load will be applied to the right hand side of the geometry shown below. The specimen was modeled as steel with a modulus of elasticity of 200 GPa.



ANSYS Command Listing

```
finish
/clear

/title, Convection Example
/prep7                          ! Enter the preprocessor

! define geometry

k,1,0,0                         ! Define keypoints
k,2,0.03,0
k,3,0.03,0.03
k,4,0,0.03
a,1,2,3,4                       ! Connect the keypoints to form area
```

```
! mesh 2D areas

ET,1,Plane55                    ! Element type

MP,Dens,1,920                   ! Define density
mp,c,1,2040                     ! Define specific heat
mp,kxx,1,1.8                    ! Define heat transfer coefficient

esize,0.0005                    ! Mesh size
amesh,all                       ! Mesh area

finish
/solu                           ! Enter solution phase

antype,4                        ! Transient analysis

time,60                         ! Time at end of analysis

nropt,full                      ! Newton Raphson - full
lumpm,0                         ! Lumped mass off
nsubst,20                       ! Number of substeps, 20
neqit,100                       ! Max no. of iterations
autots,off                      ! Auto time search off
lnsrch,on                       ! Line search on
outres,all,all                  ! Output data for all substeps
kbc,1                           ! Load applied in steps, not ramped

IC,all,temp,268                 ! Initial conditions, temp = 268

nsel,s,ext                      ! Node select all exterior nodes
sf,all,conv,10,368              ! Apply a convection BC
nsel,all                        ! Reselect all nodes
/gst,off                        ! Turn off graphical convergence monitor

solve
finish

/post1                          ! Enter postprocessor
set,last                        ! Read in last subset of data
etable,melty,temp,              ! Create an element table
esel,s,etab,melty,273           ! Select all elements from table above 273
finish

/solu                           ! Re-enter solution phase
antype,,rest                    ! Restart analysis
ekill,all                       ! Kill all selected elements
esel,all                        ! Re-select all elements

finish

/post1                          ! Re-enter postprocessor
set,last                        ! Read in last subset of data
esel,s,live                     ! Select all live elements
plnsol,temp                     ! Plot the temp contour of the live elements
```