

# ME345: Modeling and Simulation

## Using Paths to Post-Process Results with ANSYS<sup>1</sup>

Stevens Institute of Technology

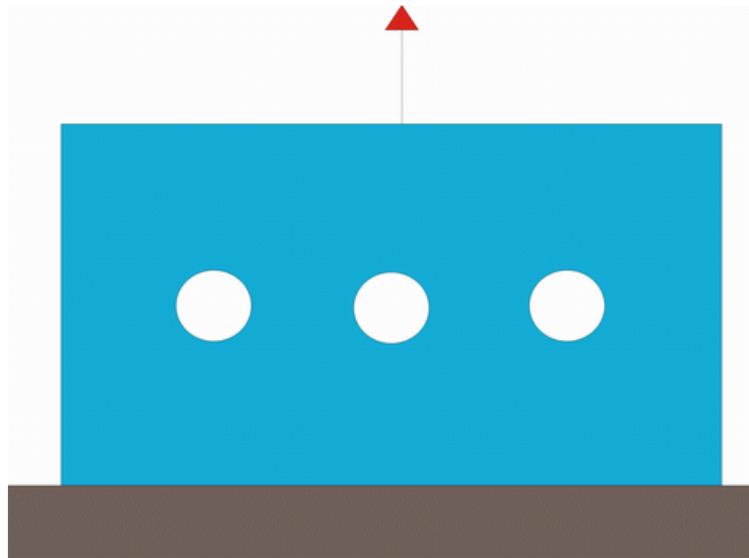
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Last Updated: 11/22/2015

### Introduction

This tutorial was created using ANSYS 16.1. The purpose of this tutorial is to create and use 'paths' to provide extra detail during post-processing. For example, one may want to determine the effects of stress concentrators along a certain path. Rather than plotting the entire contour plot, a plot of the stress along that path can be made.



In this tutorial, a steel plate measuring 200 mm x 100 mm x 10 mm will be used. Three holes are drilled through the vertical centerline of the plate. The plate is constrained at the bottom and a uniform, distributed load is pulling on the top of the plate.

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<sup>1</sup> This tutorial is based on a set of tutorials developed by Dr. Walied Moussa at the University of Alberta. See <http://www.mece.ualberta.ca/tutorials/ansys/index.html>

## Pre-processing: Defining the Problem

### 1) Give the project a title

- a) Utility Menu > File > Change Title > “Use of Paths for Post Processing”

### 2) Create rectangular area

- a) Preprocessor > Modeling > Create > Areas > Rectangle > By 2 Corners
  - i) WP X = WP Y = 0
  - ii) Width = 200mm
  - iii) Height = 100mm

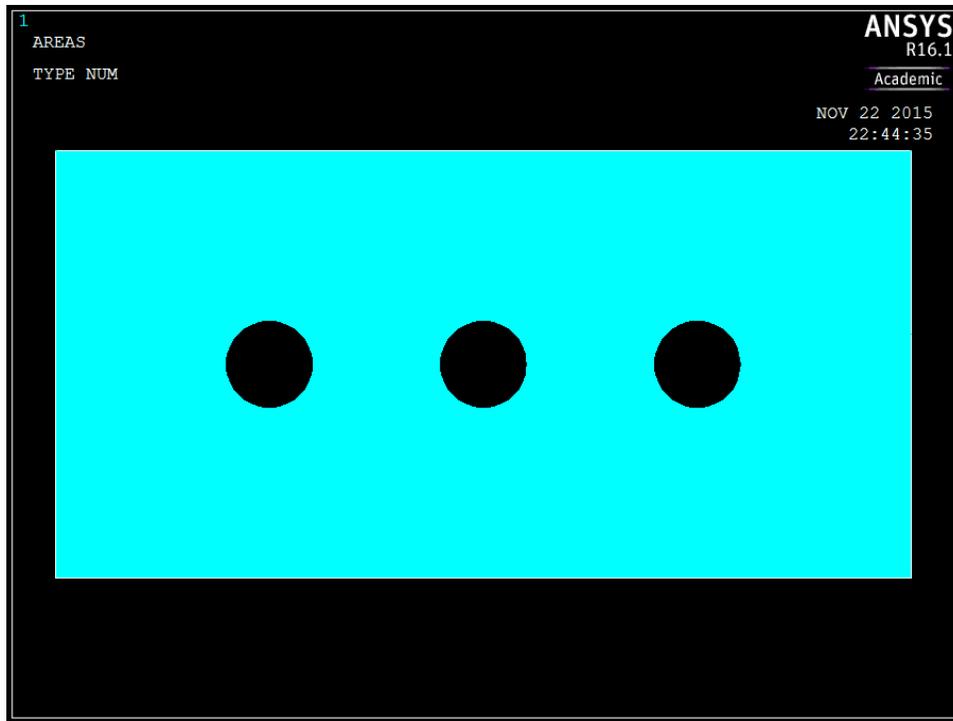
### 3) Create circle areas

- a) Preprocessor > Modeling > Create > Areas > Circle > Solid Circle
- b) Create three circles as follows:

| <b>Circle</b> | <b>WP X</b> | <b>WP Y</b> | <b>Radius</b> |
|---------------|-------------|-------------|---------------|
| 1             | 50          | 50          | 10            |
| 2             | 100         | 50          | 10            |
| 3             | 150         | 50          | 10            |

### 4) Subtract the circle areas

- a) Preprocessor > Modeling > Operate > Booleans > Subtract > Areas
- b) First, select the area to remain (i.e. the rectangle) and click OK
- c) Then, select the areas to be subtracted (i.e. the three circles) and click OK



#### 5) Define the element type

- a) Preprocessor > Element Type > Add/Edit/Delete > Add... > Solid -- 8node 183 element
- b) In the 'Element Types' window, click 'Options...' and set 'Element behavior' to 'Plane strs w/thk'

#### 6) Define real constants

- a) Preprocessor > Real Constants > Add...
- b) In the 'Real Constants for PLANE183' window, enter a thickness of 10

#### 7) Define element material properties

- a) Preprocessor > Material Props > Material Models > Structural > Linear > Elastic > Isotropic
- b) In the window that appears, enter the following geometric properties for steel:
  - i) Young's modulus EX = 200000
  - ii) Poisson's Ratio PRXY = 0.3

#### 8) Define mesh size

- a) Preprocessor > Meshing > Size Cntrl > ManualSize > Areas > All Areas > Element edge length = 5

## 9) Mesh the area

- a) Preprocessor > Meshing > Mesh > Areas > Free > 'Pick All'

## Solution: Assigning Loads and Solving

### 10) Define analysis type

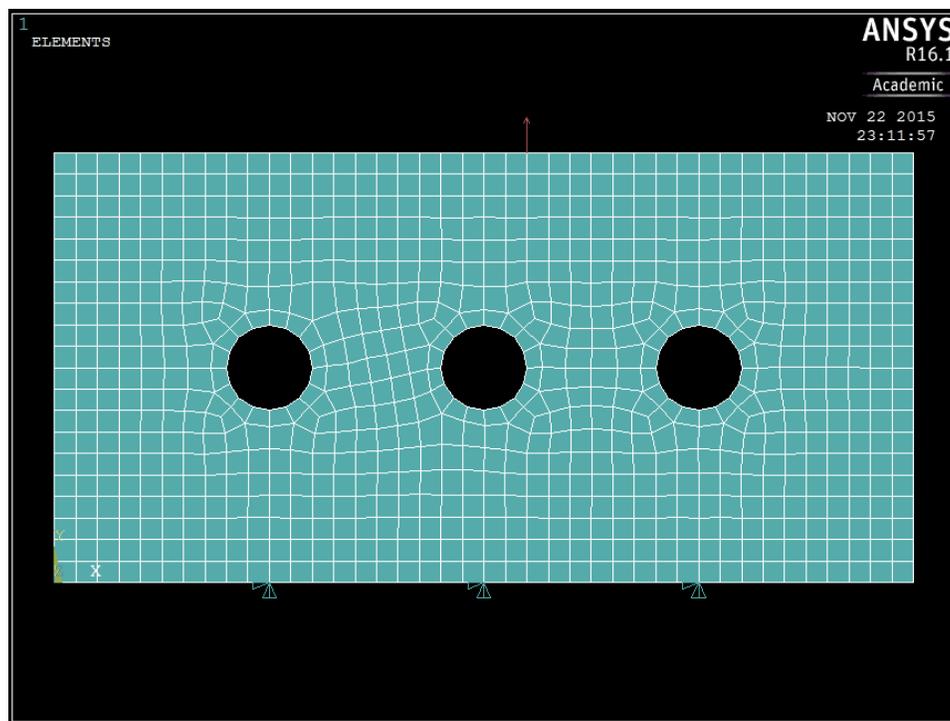
- a) Solution > Analysis Type > New Analysis > Static

### 11) Apply constraints

- a) Solution > Define Loads > Apply > Structural > Displacement > On Lines
  - i) Constrain ALL DOF for the bottom of the area

### 12) Apply loads

- a) Solution > Define Loads > Apply > Structural > Pressure > On Lines
  - i) Apply a constant, uniform pressure load of -200 on the top of the area



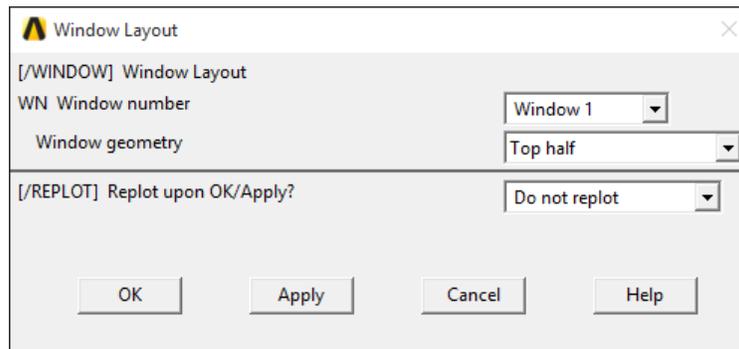
### 13) Solve the system

- a) Solution > Solve > Current LS

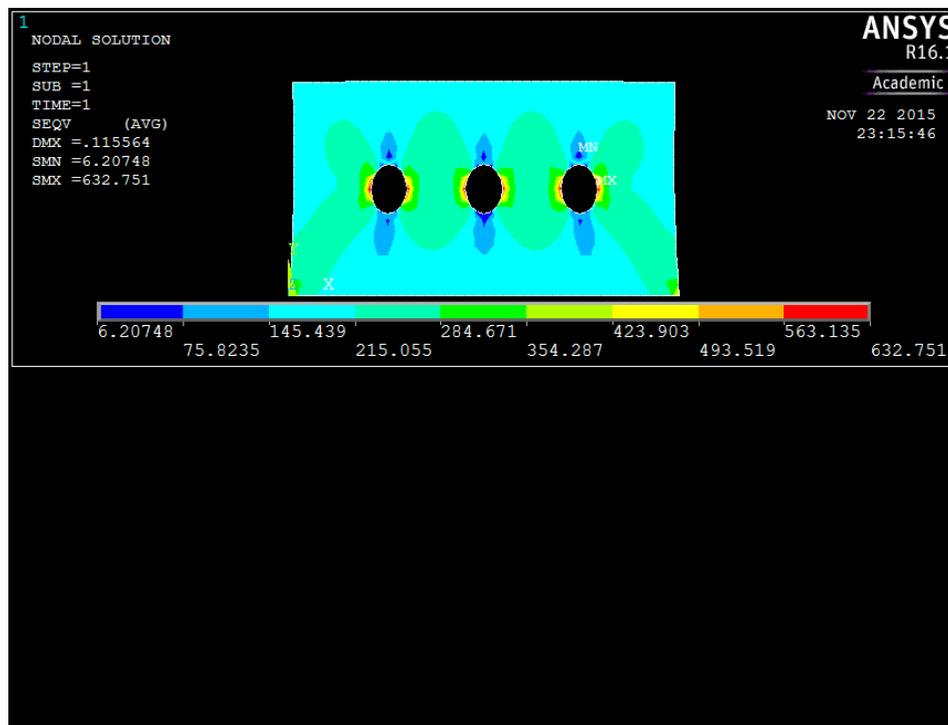
## Post-processing: Viewing the Results

### 14) Contour Plot

- Utility Menu > PlotCtrls > Window Controls > Window Layout
- Fill in the 'Window Layout' window as shown below:



- General Postproc > Plot Results > Contour Plot > Nodal Solu > Stress > von Mises



To ensure the top plot is not erased when the second plot is created, you must make a couple of changes.

- d) Utility Menu > PlotCtrls > Window Controls > Window On or Off
  - i) Turn Window 1 'Off'
- e) Utility Menu > PlotCtrls > Erase Option > Erase Between Plots
  - i) Ensure there is no check-mark, meaning this function is off. This will keep Window 1 visible during replots
- f) Utility Menu > PlotCtrls > Window Controls > Window Layout
  - i) Select 'Window 2 > Bottom Half > Do not replot'

### 15) Create Path

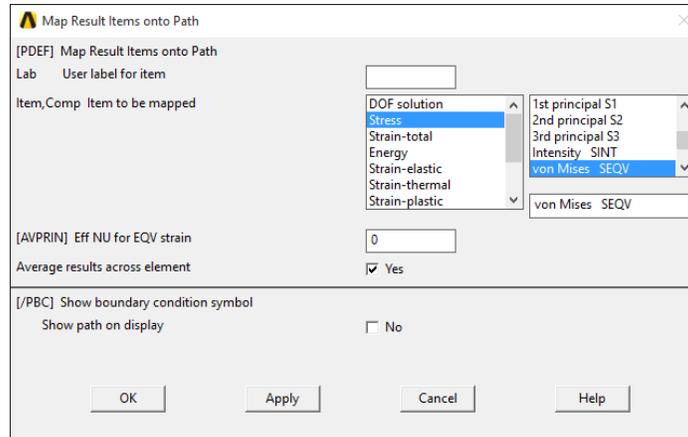
- a) General Postproc > Path Operations > Define Path > By Location
  - i) In the window shown below, name the path 'Cutline' and set the 'Number of divisions' to 1000
  - ii) Fill the next two windows with the following parameters:

| <b>Path Point Number</b> | <b>X Loc</b> | <b>Y Loc</b> | <b>Z Loc</b> |
|--------------------------|--------------|--------------|--------------|
| 1                        | 0            | 50           | 0            |
| 2                        | 200          | 50           | 0            |

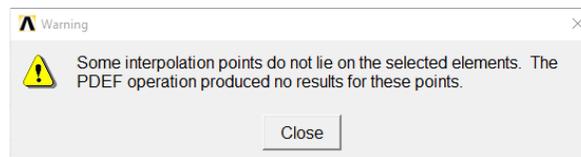
- iii) When the third window pops up, click 'Cancel' because we only enabled two points on the path in the previous step

### 16) Map the Stress onto the Path

- a) Now that the path is defined, you must choose what to map to the path (i.e. what results should be available to the path). For this example, equivalent stress is desired.
  - i) General Postproc > Path Operations > Map onto Path
  - ii) Fill in the next window as shown below (Stress > von Mises) and click OK:

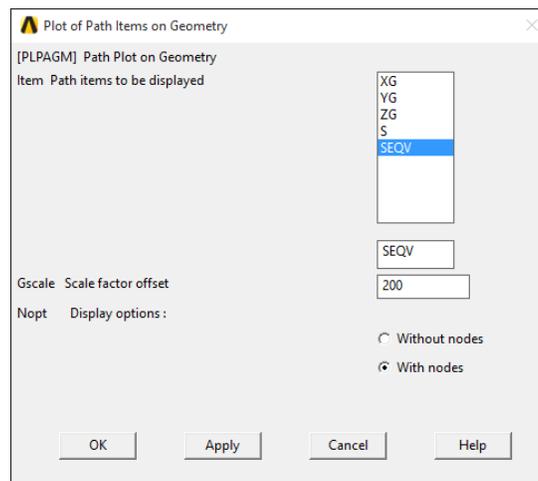


iii) The warning shown below will probably pop up. This is just saying that some of the 1000 points you defined earlier are not on interpolation points (special points on the elements) and therefore there is no data to map. This is of little concern since there are plenty of points that do lie on interpolation points to produce the necessary plot, so disregard the warning.



## 17) Plot the Path Data

- a) General Postproc > Path Operations > Plot Path Item > On Geometry
  - i) Fill in the window as shown below:



- ii) The stress path plot makes it easy to visualize the stress concentration around the holes in the plate

