

# ANSYS - Disks in Point Contact - Step 4

## Problem Specification

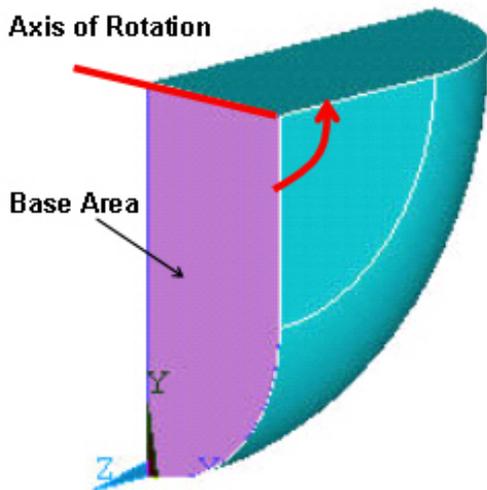
1. Start-up and preliminary set-up
2. Specify element type and constants
3. Specify material properties
- 4. Specify geometry**
5. Mesh geometry
6. Specify boundary conditions
7. Solve
8. Postprocess the results
9. Validate the results

## Step 4: Specify geometry

Because of the inherent symmetry of the model, we'll perform the analysis on a quarter of the volumes only. Recall that  $\alpha=0$  (i.e. angle between the planes in which radii  $R_1$  and  $R_2$  lie is zero). As a result, the upper and lower volume have the same orientation, when viewed from the top.

We'll generate the volumes by first creating two base areas and then rotating them about an axis/line. The base area for the upper disk is shown in purple and the axis of rotation in red in the figure below.

We will define the origin of the coordinate system to be at the point of contact.



## Create Keypoints

Main Menu > Preprocessor > Modeling > Create > Keypoints > In Active CS

In order to build the geometry so that the disks are just touching, we will use scalar parameter *inter*. We'll specify all the keypoints from which the upper base area will be generated, to be displaced in the negative y direction by a distance *inter*.

Enter the keypoint locations:

Keypoint 1:  $X=0$ ,  $Y=0$ ,  $Z=0$ , Click **Apply**.

Keypoint 2:  $X=R_2$ ,  $Y=-R_2$ ,  $Z=0$ , Click **Apply**.

Keypoint 3:  $X=R_2$ ,  $Y=-R_2p$ ,  $Z=0$ , Click **Apply**.

Keypoint 4:  $X=0$ ,  $Y=-R_2p$ ,  $Z=0$ , Click **Apply**.

Keypoint 5:  $X=0$ ,  $Y=-inter$ ,  $Z=0$ , Click **Apply**.

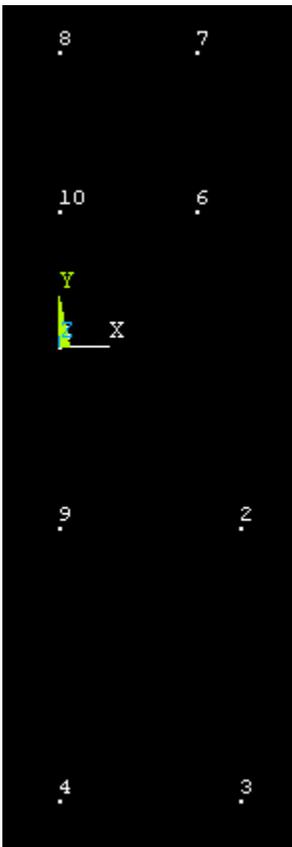
Keypoint 6:  $X=R_1$ ,  $Y=R_1-inter$ ,  $Z=0$ , Click **Apply**.

Keypoint 7:  $X=R_1$ ,  $Y=R_1p-inter$ ,  $Z=0$ , Click **Apply**.

Keypoint 8:  $X=0$ ,  $Y=R_1p-inter$ ,  $Z=0$ , Click **Apply**.

Keypoint 9:  $X=0$ ,  $Y=-R_2$ ,  $Z=0$ , Click **Apply**.

Keypoint 10:  $X=0$ ,  $Y=R_1-inter$ ,  $Z=0$ , Click **OK**.



## Create Lines

Main Menu > Preprocessor > Modeling > Create > Lines > Lines > In Active Coord

This brings up the *Lines in Active Coord* pick menu.

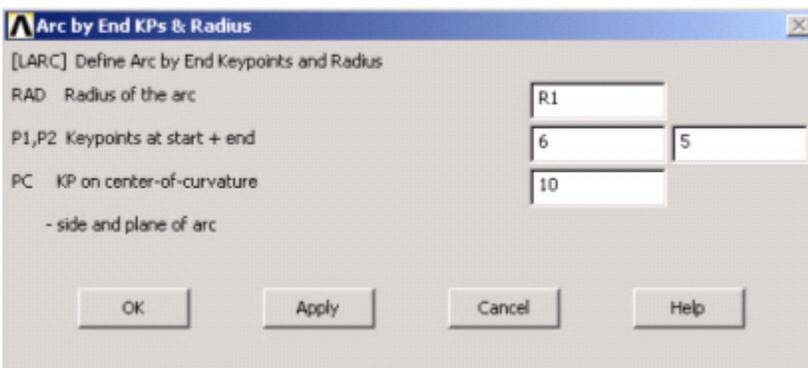
Start by creating the line between keypoints 2 and 3. Click on keypoint 2 and then keypoint 3. Similarly, create lines between keypoints 3 & 4, 4 & 1, 6 & 7, 7 & 8 and 8 & 5.

Main Menu > Preprocessor > Modeling > Create > Lines > Arcs > By End KPs & Rad

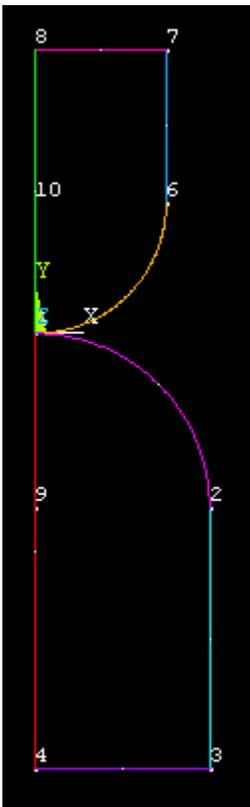
This brings up the *Arc by End KPs & Rad* pick menu.

Start by creating the arc between keypoints 6 and 5. Click on keypoint 6 and then keypoint 5. These are the keypoints at start and end of arc. Click **OK**. Then, click on keypoint 10. This is the keypoint on the center-of-curvature side and plane of arc. Click **OK**.

This brings up the *Arc by End KPs and Radius* menu. Enter  $\{R1\}$  for **RAD Radius of the arc**. The other parameters (keypoints at start, end and center of curvature) are automatically selected and we don't need to change them. Click **Apply**.



Similarly, create the arc between keypoints 2 and 1, using keypoint 9 as the center-of-curvature and  $R2$  as the **RAD Radius of the arc**.



At this point we have all the lines and arcs needed to create the areas.

### Create Areas

Main Menu > Preprocessor > Modeling > Create > Areas > Arbitrary > By Lines

This brings up the *Create Area by Lines* pick menu. Select lines 4, 5, 6 and 7 to create the upper area. Click **Apply**. Similarly, select lines 1, 2, 3 and 8 to create the lower area. Click **OK**.

Note that you can also generate the areas by creating two squares and two circular sectors, and then adding them using boolean operations. This method generates the same end result.

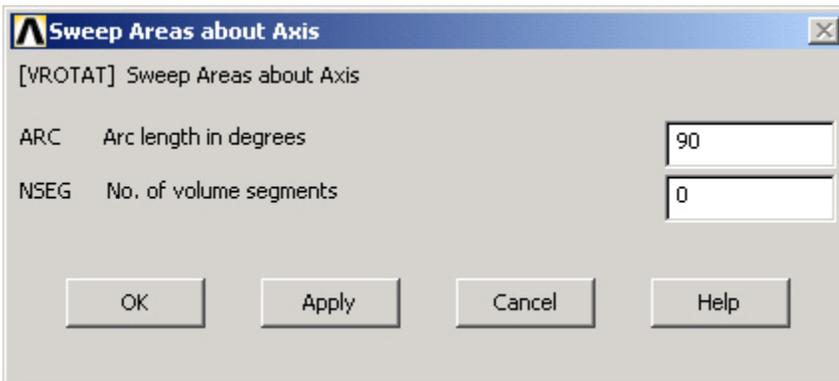
### Create Volumes

To create the volumes, we will rotate each of the areas about a line/axis.

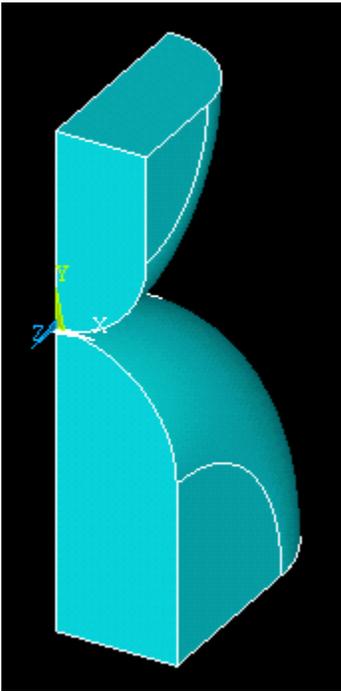
Main Menu > Preprocessor > Modeling > Operate > Extrude > Areas > About Axis

This brings up the *Sweep Areas about Axis* pick menu. In the *Input* window, ANSYS tells you to "pick or enter areas to be swept about axis". Select the upper area (1) and click **OK**. ANSYS tells you to "pick or enter two keypoint defining the axis". Select keypoint 8 first and then keypoint 7, click **OK**.

This brings up the *Sweep Areas about Axis* menu. This menu allows you to specify the angle by which the area will be rotated about the axis. Clearly, we want to rotate the area 90 degrees to generate the volume, but there are two options: +90 or -90. The sign is determined by the keypoint selection made in the previous step. Since we selected keypoint 8 first and then keypoint 7, the axis goes from 8 to 7. As a result, we want to rotate the area +90 degrees (use the right hand rule to visualize this) so that the area is rotated in the negative z direction. Enter 90 for **ARC Arc length in degrees**. Since we don't want segments or divisions in the volume, enter 0 for **NSEG No. of volume segments**. Click **Apply**.



Repeat the same procedure to generate the lower volume. Start by selecting the lower area (2). Click **OK**. Then select keypoint 3 first and then keypoint 4, click **OK**. In the following menu, enter 90 for **ARC Arc length in degrees** and 0 for **NSEG No. of volume segments**. Click **OK**.



If you did this correctly, you will see that both areas are rotated 90 degrees in the negative z direction. Note that the key step here is to specify a rotation angle consistent with your selection of initial and final keypoints, following the right hand rule.

### Save Your Work

Toolbar > SAVE\_DB

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Go to [all ANSYS Learning Modules](#)