

ANSYS WB - Bike Crank - Solution

Author: Benjamin Mullen, Cornell University

Problem Specification

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Solution

Deformation

Although we are only looking for the strain at the strain gauge location, we should also check the deformation of the crank to see if the solution makes intuitive sense. This will allow us to catch any obvious errors we have made setting up the simulation. To add deformation to the solution, first click




Solution (B5)

to add the solution sub menu to menu bar. Now in the solution sub menu click **Deformation > Total** to add the total deformation to the solution. It should appear in the outline tree.

Stress

We will also look at the stress of the bar to verify the simulation against the theory. In the solution sub menu, select **Stress > Normal**. In the details pane, ensure **Orientation** is set to **X Axis**, and **Geometry** is set to **All Bodies**. Rename the Stress to **StressXX**. Now, create another stress the same way, but change **Orientation** to **Y Axis** and rename it **StressYY**


Construction Geometry

The next thing we are going to do is to set up a path where the strain gauge lies on the bike crank. In the outline window, click  **Model**. Next, go to **Construction Geometry > Path**. This will open up the path toolbox in the details window. Creating a path in Workbench is very easy: you just have to specify the starting and ending points of your path and workbench will create it. In the details window, enter **(3.3748, -.20512, 0.375)** as the starting point and **(3.3748, 0.016929, 0.375)** as the end point. Change the number of sampling points to **50**.

Details of "Path"	
Definition	
Path Type	Two Points
Path Coordinate System	Global Coordinate System
Number of Sampling Points	50.
Suppressed	No
Show Mesh	No
Start	
Coordinate System	Global Coordinate System
Start X Coordinate	3.3748 in
Start Y Coordinate	-0.2051 in
Start Z Coordinate	0.375 in
Location	Click to Change
End	
Coordinate System	Global Coordinate System
End X Coordinate	3.3748 in
End Y Coordinate	1.69e-002 in
End Z Coordinate	0.375 in
Location	Click to Change

When the parameters of the path have been set, right click on the path you just created in the project tree in the outline window and select **Rename**. Rename the path, **Strain Gauge**.

If your default coordinate system is not centered on one of the holes in the crank, or you wish to learn how to define new coordinate systems inside the mechanical window, please refer to the following video:



Why Are We Creating a Path to Represent the Strain Gauge?


We are trying to find the average of the strain over the entire area of the strain gauge. However, lucky for us, the strain does not vary much in the x-direction of the bike crank. Therefore, we can neglect the strain changes in the x-direction, and assume strain only varies in the y-direction. This allows us to use a line as a representation of the strain gauge, making our analysis simpler and not harming our results.

An alternate, more difficult, and more accurate method than using paths is to use surface bodies to average the strain over the entire area covered by the strain gauge. The video below walks you through this process.

Strain

In the Solution sub menu select **Strain > Normal**. Now, we need to specify that we want the strain to be measured at the stain gauge in the y direction. To accomplish this, go to **Scoping Method > Path**, the select **Path > Strain Gauge** in the details window. To change the direction of the strain, select **Orientation > Y Axis**. The rest of the default options should suffice for our simulation.

Details of "Normal Elastic Strain"	
[-] Scope	
Scoping Method	Path
Path	Strain Gauge
Geometry	All Bodies
[-] Definition	
Type	Normal Elastic Strain
Orientation	Y Axis
By	Time
Display Time	Last
Coordinate System	Global Coordinate System
Calculate Time History	Yes
[-] Integration Point Results	
Display Option	Averaged
[-] Results	
<input type="checkbox"/> Minimum	-4.9324e-005 in/in
<input type="checkbox"/> Maximum	1.3965e-004 in/in
[-] Graph Controls	
X-Axis	S
[+] Information	

We are ready to solve the simulation. Press 

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