Bending of a Curved Beam (Results-Interpretation) - Pre-Analysis & Start-Up

Author: Benjamin Mullen, Cornell University

Pre-Analysis & Start-Up

Pre-Analysis

There are three difference theories for finding the solution for the bending of a curved beam. There is elasticity theory, where

$$\sigma_r = (\frac{4M}{tb^2 N})[(1 - \frac{a^2}{b^2}) \ln(\frac{r}{a}) - (1 - \frac{a^2}{b^2}) \ln(\frac{b}{a})]$$

and

$$\sigma_\theta = (\frac{4M}{tb^2 N})[(1 - \frac{a^2}{b^2})(1 + \ln(\frac{r}{a})) - (1 + \frac{a^2}{r^2}) \ln(\frac{b}{a})]$$

where

$$N = (1 - \frac{a^2}{b^2})^2 - 4(\frac{a^2}{b^2}) \ln^2(\frac{b}{a})$$

There is Winkler Bach Theory, where

$$\sigma_\theta = \frac{M}{AR}[1 + \frac{y}{Z(R + y)}]$$

where

$$Z = -1 + \frac{R}{h} \ln[(R + \frac{h}{2})/(R - \frac{h}{2})]$$

And there is the straight beam theory, where

$$\sigma_\theta = \frac{My}{I}$$

ANSYS Simulation

Now, let's load the problem into ANSYS and see how a computer simulation will compare. First, start by downloading the files here
The zip file should contain the following contents:

- Curved Beam Solution_files folder
- Curved Beam Solution.wbpj

Please make sure to extract both of these files from the zip folder, the program will not work otherwise. (Note: The solution was created using ANSYS workbench 13.0 release, there may be compatibility issues when attempting to open with older versions).

2. Double click "Curved Beam Solution.wbpj" - This should automatically open ANSYS workbench (you have to twiddle your thumbs a bit before it opens up). You will be presented with the ANSYS solution.

A tick mark against each step indicates that that step has been completed.

3. To look at the results, double click on "Results" - This should bring up a new window (again you have to twiddle your thumbs a bit before it opens up).

4. On the left-hand side there should be an "Outline" toolbar. Look for "Solution (A6)".
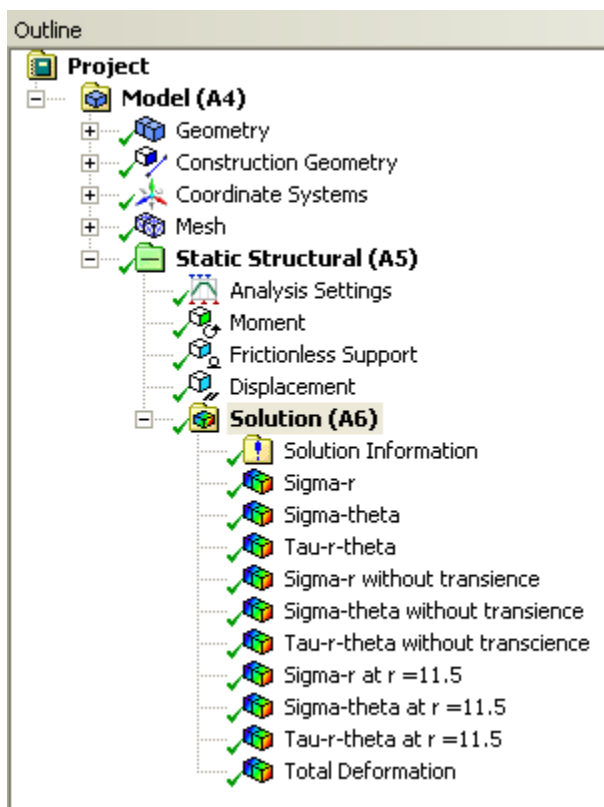
We'll investigate the items listed under Solution in the next step in this tutorial.

Go to Step 2 - Numerical Results

Go to all ANSYS Learning Modules