

Intro Learning Module - sigma_x for inner radius = 1cm

Author: Rajesh Bhaskaran, Cornell University

Problem Specification

1. Find Reactions R_A , R_B
2. Calculate σ_x for $r_i = 1$ cm
3. Plot σ_x vs. r_i
4. σ_x vs. r_i (Take 2)
5. σ_x vs. r_i (Take 3: File Input/Output)
6. σ_x vs. r_i (Take 4: Functions)

Tips

Comments

Calculate σ_x for $r_i = 1$ cm

Remember elementary statics? It gives the bending stress at point O as

$$\sigma_x = \frac{My}{I} \quad y = r_o$$

$$M = -600 \text{ Nm}$$

$$I = \frac{\pi(r_o^4 - r_i^4)}{4}$$

Using my calculator, I get $\sigma_x = -101.7$ MPa. We'll check the MATLAB result against this value.

Calculate σ_x at point O

In your program, leave a blank line and start a new section for calculating σ_x at point O with an explanatory comment line. Then, create the parameters M , r_o , and r_i since these are needed to calculate σ_x .

```
5  
6 %Calculate sigma_x  
7 - M = -600;  
8 - ro = 2e-2;  
9 - ri = 1e-2;
```

Following this is the statement to calculate I , the moment of inertia:

```
10 - I = pi*(ro^4 - ri^4)/4;
```

Things to note: the parameter pi is predefined and contains a very accurate value of π . The operator ^ is used to raise a quantity to a desired power. Now we can calculate σ_x at O:

```
11 - sigma_x = 1e-6*M*ro/I
```

The factor 10^{-6} above converts the result into MPa. The semi-colon at the end of the line is left off so that we can see what the resulting value of **sigma_x** is. Click on the *Run* icon in the editor (or hit the *F5* key). What is the value of σ_x reported by your program? I get

```
sigma_x =  
-101.8592
```

This is close enough to my paper-and-pencil result of -101.7 MPa above. See my [entire program here](#) (right click and select save target as, or just left-click and copy-paste in the editor).

[Go to Step 3: Plot \$\sigma_x\$ vs. \$r_i\$](#)

[Go to all MATLAB Learning Modules](#)