## AIM Cantilever Beam Modal Analysis - Pre-Analysis & Start-Up

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- **Problem Specification**
- 1. Pre-Analysis & Start-Up 2. Geometry
- 3. Mesh 4. Physics Setup
- 5. Numerical Solution & Results

## Pre-Analysis & Start-Up

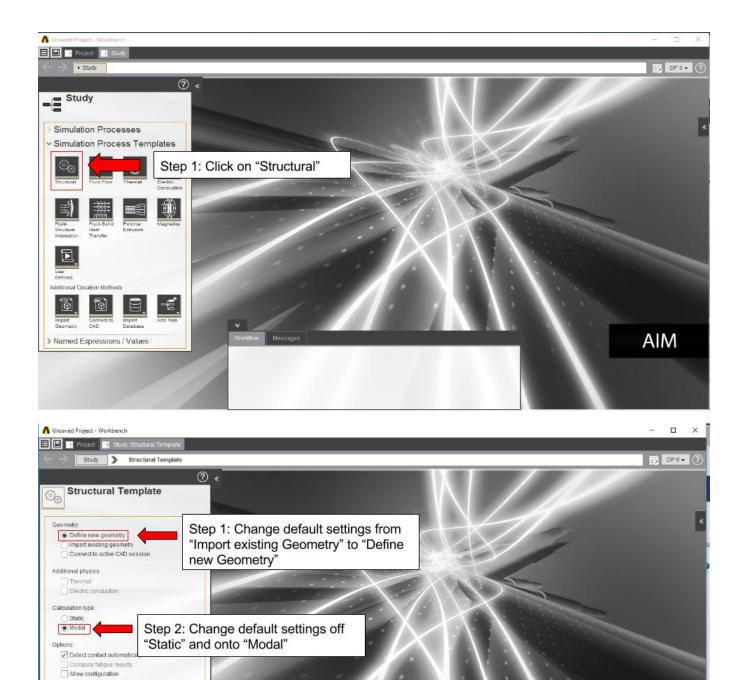
## **Pre-Analysis**

The following equations give the frequencies of the modes and the mode shapes and are derived from Euler-Bernoulli Beam Theory.

$$\begin{split} & w_n = \alpha_n^2 \sqrt{\frac{EI}{ml^3}} \\ & n = 1, 2, 3, \dots \\ & \alpha_n = 1.875, 4.694, 7.855, \dots \\ & m = \rho V = \rho \cdot l \cdot h \cdot w \\ & I = \frac{w \cdot h^3}{12} \\ & w_1 = 1.875^2 \sqrt{\frac{70 \ E9 \ \frac{kg}{m \cdot 2} \cdot \frac{0.346m \cdot (0.346m)^3}{12}}{\sqrt{2.7 \ E3 \ \frac{kg}{m^3} \cdot 4m \cdot 0.346m \cdot 0.346m \cdot (4m)^3}} = 111.7 \ \frac{r_{ad}}{s} = 17.8 \ Hz \\ & w_2 = 4.694^2 \sqrt{\frac{70 \ E9 \ \frac{kg}{m \cdot 2} \cdot \frac{0.346m \cdot (0.346m)^3}{12}}{\sqrt{2.7 \ E3 \ \frac{kg}{m^3} \cdot 4m \cdot 0.346m \cdot 0.346m \cdot (4m)^3}} = 700.4 \ \frac{r_{ad}}{s} = 111.5 \ Hz \\ & w_3 = 7.855^2 \sqrt{\frac{70 \ E9 \ \frac{kg}{m \cdot 2} \cdot \frac{0.346m \cdot (0.346m)^3}{12}}{\sqrt{2.7 \ E3 \ \frac{kg}{m^3} \cdot 4m \cdot 0.346m \cdot 0.346m \cdot (4m)^3}} = 1961.2 \ \frac{r_{ad}}{s} = 312.1 \ Hz \\ & y_i(x) = \cosh(\frac{\alpha_i x}{L}) - \cos(\frac{\alpha_i x}{L}) - \sigma_i(\frac{\sinh(\frac{\alpha_i x}{L})}{L} - \sin(\frac{\alpha_i x}{L})) \\ & \alpha_i = 1.875, 4.694, 7.855, \dots \end{split}$$

 $\sigma_i = 0.73409, \ 1.018647, \ 0.9992245, \ \dots$ 

Start-Up



Step 3: Click on Create

AIM

Simulation Process

## Go to Step 2: Geometry

Go to all ANSYS AIM Learning Modules

Typical settings and results will be defined automatically

Create Simula

Cancel