

Engineering Studies Year 12. Beams analysis inside Fusion360.

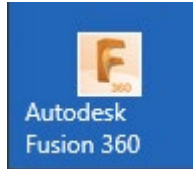
Get an account

If you do not have one, go to this link and create an account and download the software.

<https://www.autodesk.com/products/fusion-360/students-teachers-educators>

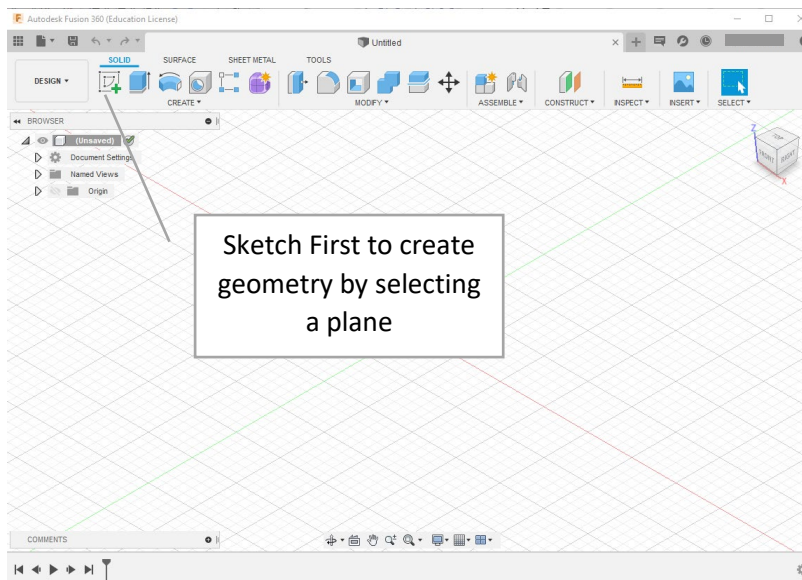
Create an ACCOUNT and download the software to use at home. Use your education related email address. Your school may already have the software installed. Fusion360 is an Autodesk product.

Launch Fusion360



Be patient, it sets up graphics and a lot of programs to calculate geometry.

Get used to the Interface



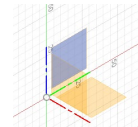
You will sketch on the Right Hand Plane (YZ) to create the Cross Section of a Standard Cross Section Beam. (an **I** beam).

Do this by clicking the

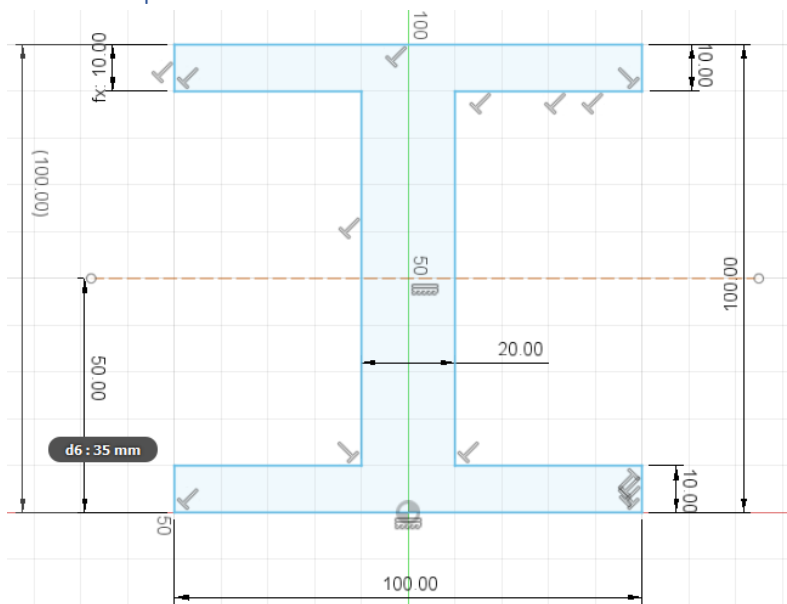


SKETCH icon.

Then select the YZ plane.



Draw the profile sketch



Draw this sketch carefully.

Add Dimensions by selecting



the tool or by tapping **D** on the keyboard.

Click once on a line, move away with the mouse and click again to drop the Dimension. Change it to those indicated. Note, later we will EDIT this Sketch to make the 100 height to 200.

Use the LINE (L) tool to sketch this shape. Better is SYMMETRICAL around the YZ Origin.

EXTRUDE the length

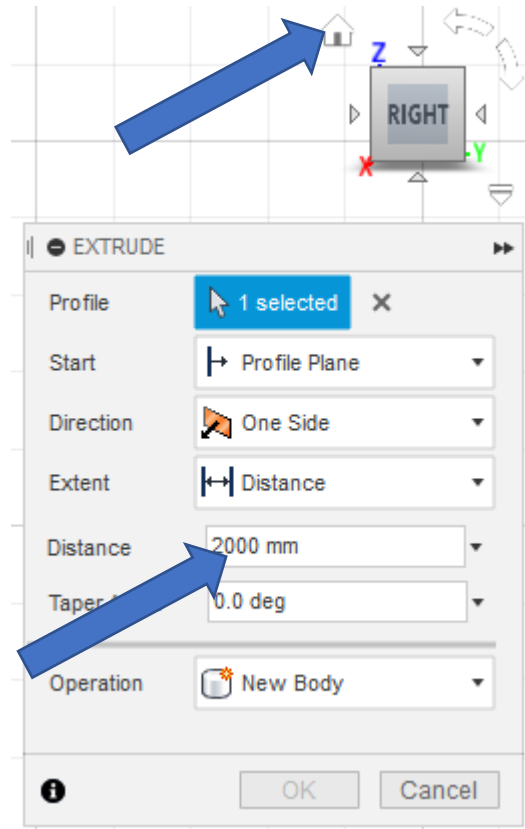
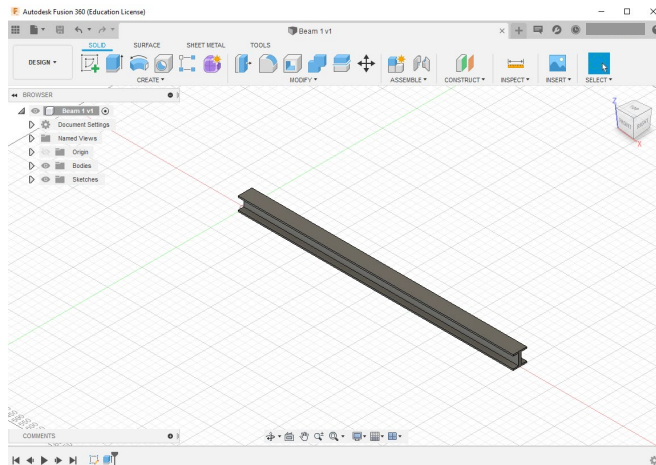
Tap **E** on the keyboard. This launches the EXTRUDE tool. Select inside the profile if necessary and extrude the length to 2m. Type 2000 as you should be working in ISO standards. If not see below.

Go Top right with your mouse to select the HOME view.

Click OK and zoom out by scrolling the mouse wheel. Or use the View tool bar at the bottom centre of the screen.

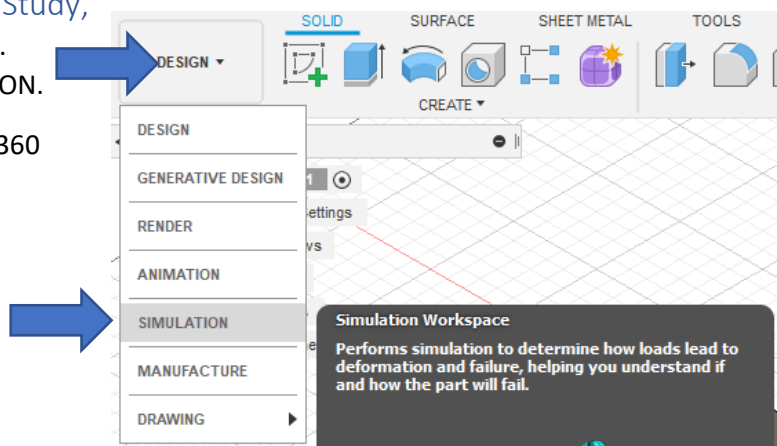


If you haven't yet SAVE YOUR WORK. Know where you saved it by READING THE SCREEN.

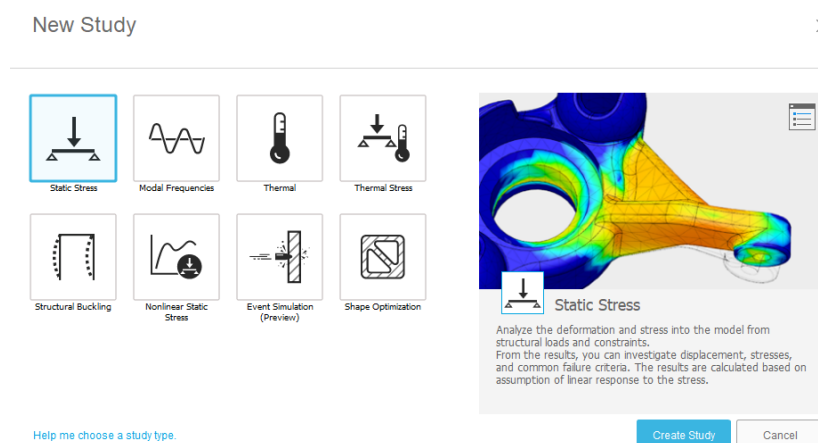


Start the Simulation, create the Study, Change the Workspace to Simulation. Click on DESIGN and select SIMULATION.

NOTE: The default material in Fusion360 is Mild Steel.



We create a STATIC STRESS study.

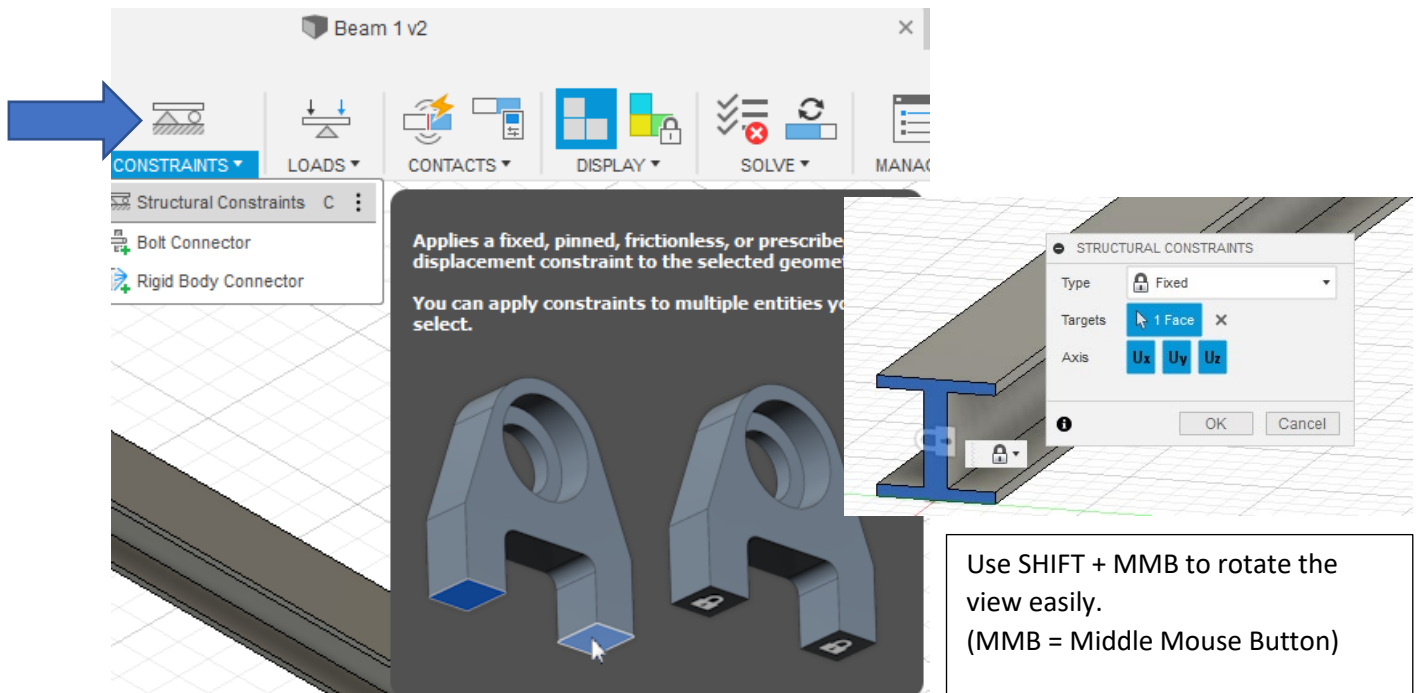


Click Create Study

Click OK to information regarding Cloud Credits if it pops up. Note 1 Credit is \$1 US, education accounts get them free because Autodesk supports engineering students.

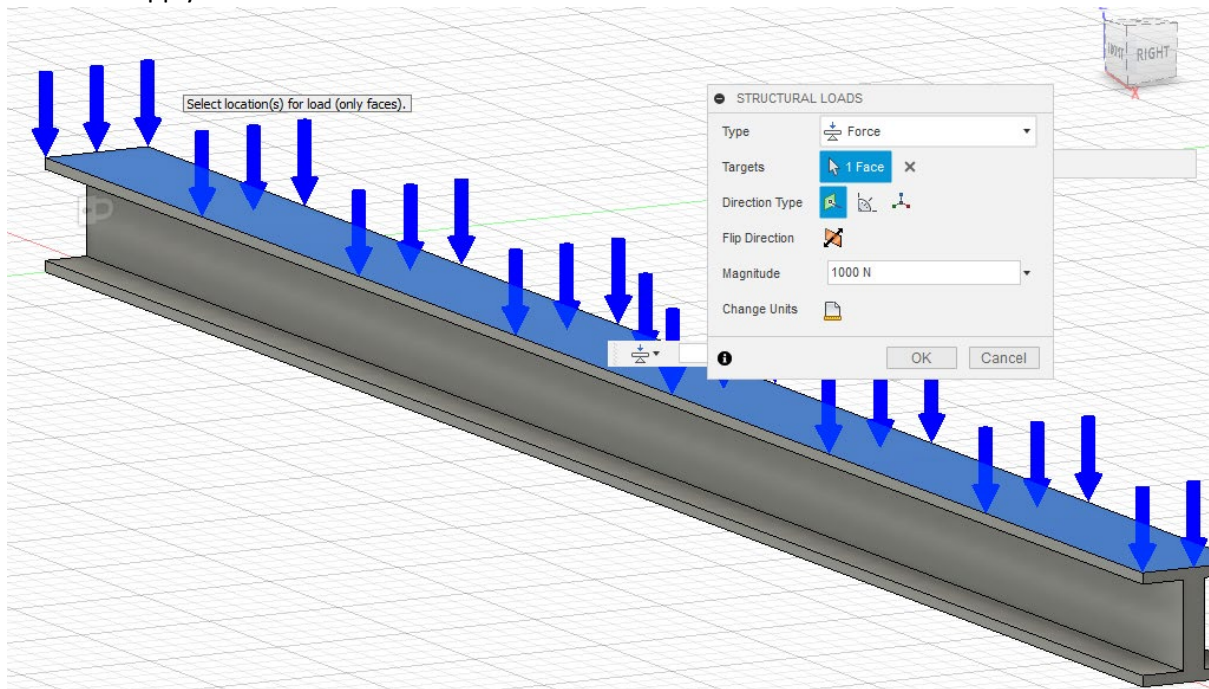
Secure one end

Go to constraints/ Structural Constraints and apply a Fixed constraint to the far end of the beam.

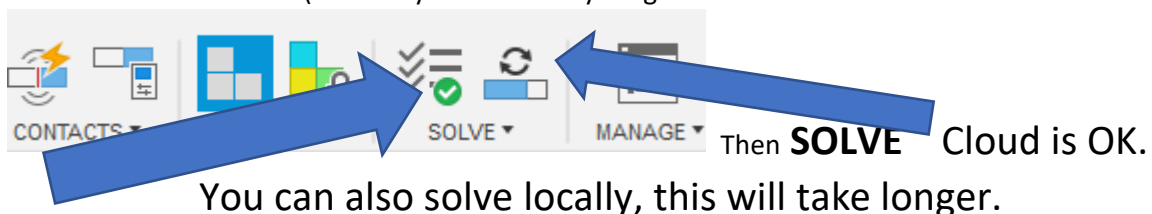


Apply a Load.

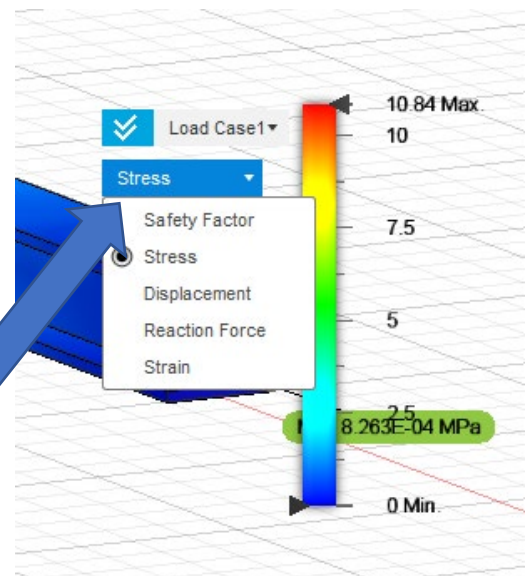
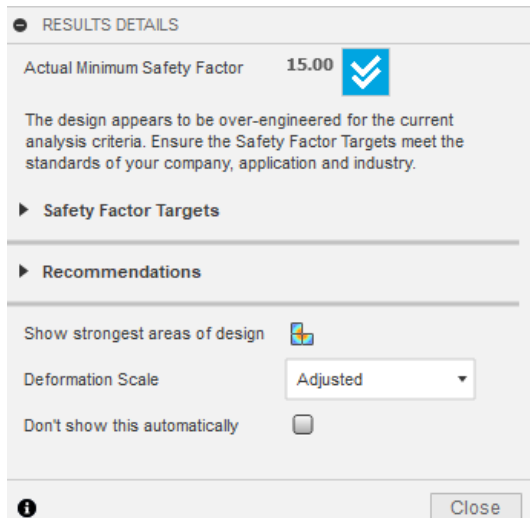
Rotate the view back to Home view. Use LOADS / Structural Loads, select the TOP SURFACE of the beam and apply 1000N.



Click OK. Do a PreCheck (to see if you missed anything).



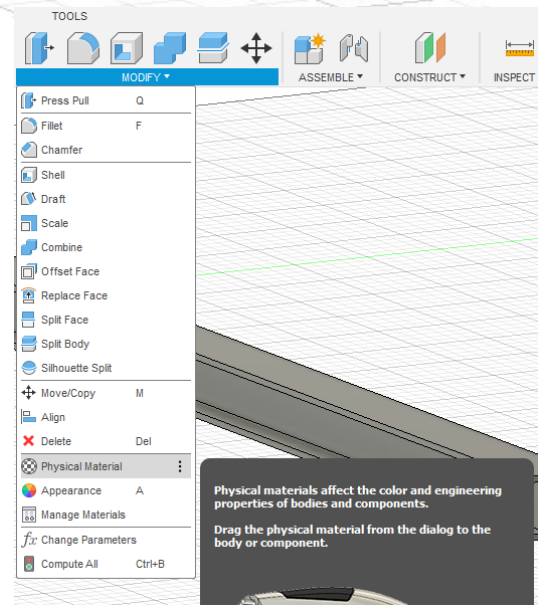
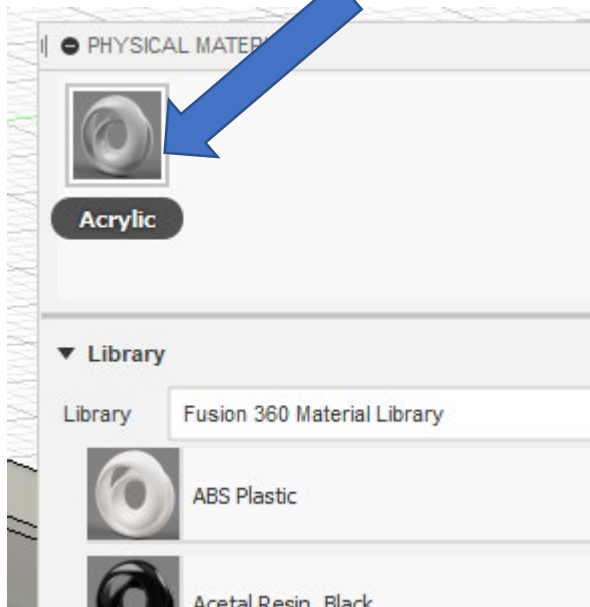
Once the STUDY has been solved, you will get a report.



Tinker with the Interface and the REPORT dialogue

Change Material and make you beam out of Acrylic.
Go → Design Workspace → Modify → Physical Material

Drag and Drop Acrylic onto the Steel icon



Rerun the Simulation Study.

Challenges:

- Find Display → Toggle Mesh Visibility. Is this FEA?
- Support your beam at both ends by adding a Constraint to the near end, run simulation studies again.
- Write a report assessing the use of Simulation in the design of structures.

1. Reduce the cross-sectional area so the safety factor of a mild steel beam is 2
2. Draw the Shear Force and bending moment diagrams. How do they differ from the information in the Simulation?
3. Reduce the mass of the beam so that it is the lightest weight for the highest safety factor. Create a Metric to measure this.
4. Reduce the mass of the beam so that it is the lightest weight for the stiffest beam (reduce bending). Create a Metric to measure this.