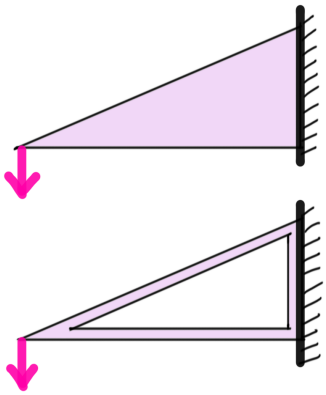
Build + Connect

#04 Cantilevers vs. Trusses

flexural stiffness vs. axial stiffness

Part I. Warm-up



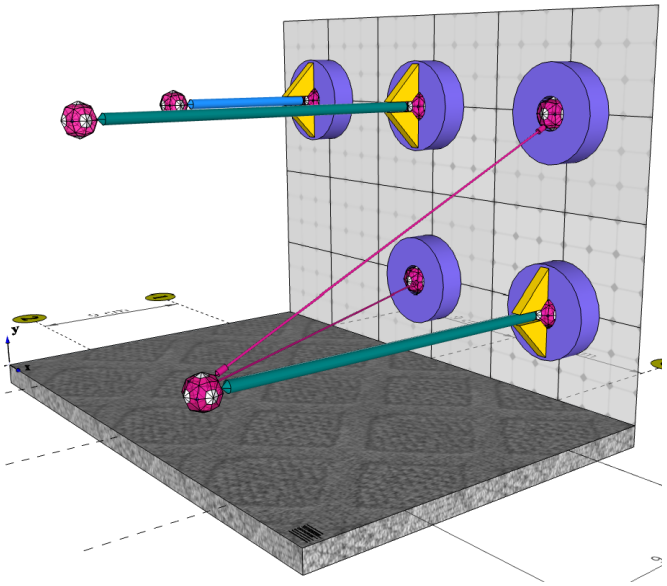
Consider the two cantilever beams at right. They are both fixed at the right end, and both support the same amount of force. The top beam is solid, and the other has a large triangular hole cut in it.

How are these beams similar? How are they different? What are the pros and cons of each design, do you think?

Is the bottom beam a truss? Why / why not?

Part II. Building

Open and build Structures-04-Cantilevers Compared to Trusses. You'll need to orient the magnetic base vertically, propping it up against a wall as shown. Build the short cantilever beam, the long cantilever beam, and then the truss-like triangular structure. You don't need to apply an external load; just observe the structural behavior under the self-weight of the sphere.



Part III. Reflect and Connect

Answer the following questions in your notebook and discuss with peers. Why are the deflections of the three structures so different, from a structural engineering perspective? Why does the triangular truss-like structure outperform the cantilever beams to such an extent? Why is axial stiffness so different compared to flexural stiffness? If you want to optimize the structural design of a cantilever, and use the minimum amount of material, would you want to use a tension member (as shown) or a compression member (not shown … but flip the base plate upside down to make this happen)? Why was out-of-plane bracing necessary for the truss-like structure, but not the other two?