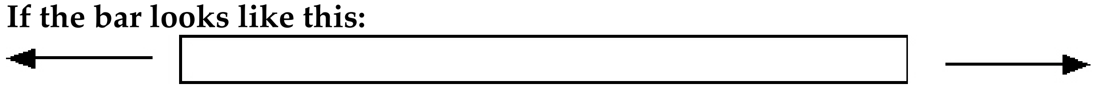
Muddy Card Responses Lecture M7

Can a section line be curved, or must it be straight. The shape does not matter. You just need to ensure that all forces (cut bars, and applied loads) that cross the section boundary are included. This is just the same as the concept of a control volume in thermodynamics or fluids.

Why is the moment sum always the perpendicular distance from the point about which the moment was taken. Why is it not just the distance? This goes back to the definition of a moment as **r x F**. The cross-product operation gives us the perpendicular component of **r** with respect to the line of action of **F**. Another way to look at this is that **F** can be resolved into a component parallel to **r** and a component perpendicular to **r**. The component parallel to r passes through the origin, the point we are taking moments about, and therefore does not have a moment arm about it.

If the bar looks like this:



where does the direction change? It doesn't. You can subdivide the bar into any section you want by "cutting" it perpendicular to the axial direction. Each such section will have forces of equal magnitude and opposite direction pulling out from each end. This is necessary if the bar is to remain in equilibrium.

How do we determine the sign of a bar force if we can't by intuition determine if the bar is under tension or compression? We generally use the convention that unknown bar forces are assumed to be tensile until proven otherwise. If by applying equilibrium we discover that the bar force was negative, then we know it was in compression and was acting in the opposite direction on the particular section (or joint) that we were analyzing.

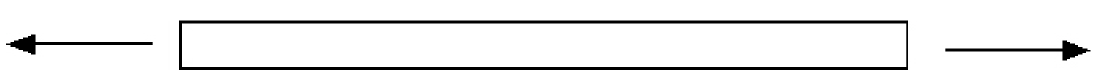
Is this the correct labeling?

Compressive: 

Tensile: 

No it is exactly the wrong way round. The compressive force pushes into the joints and the tensile force pulls out from the joints. From the bar' point of view tensile forces stretch the bar and compressive forces make it shorter.

You did a poor job explaining the distinction between "compressive" and "tensile" forces in bars. Why not just say: "bars that are under compression experience compressive forces." Hence, although the following reactionary forces seem to be expanding the bar, see diagram, they are reactionary forces to a situation of compression?



I clearly did do a poor job, because the bar that you drew is in tension. The forces acting on the bar are tending to extend the bar – i.e. make it longer. Compressive (compression) loading has the opposite effect and tends to make the bar shorter.

When we apply the method of sections or joints, sometimes it seems we ignore forces with vertical/horizontal components and only take into consideration forces that act solely in the direction of interest. Why? I am not sure exactly what you are referring to. I suspect that you are referring to my desire to try to only right equations with one unknown in them. In order to do this I look for equilibrium equations in which there is only one unknown bar with a component in a particular direction, or taking moments about a point that eliminates two bars, leaving only one with a moment arm about that point.

In the first PRS finding the reaction forces, I had the wrong answer because my signs were off – but it was only because my arrows had been drawn in different directions. Is there a convention on how to draw arrows for reaction forces? In retrospect this was not a well-posed question and I should have made the directions clearer on the figure. There is no clear convention here, but if you draw the forces in on a free body diagram it should be clear in which direction they act.

Confused about picking moment arms. It is a free choice as to where you take moments. Given that the structure is in equilibrium, you know that equilibrium of forces and moments must be satisfied regardless of the coordinate system you choose or the point about which you take moments. So pick a point that makes the calculation easiest..

Can you put up solved examples for method of structures on the web. There is a worked example in the lecture notes on the web and the solutions to M6 will go up shortly.

You can take a moment about a point in a truss if it is not in your section? Absolutely. Remember it is the line of application of a force that matters, not the particular point of application, as far as the overall equilibrium is concerned.

There were 28 cards indicating no mud, or with positive comments about the lecture, including some fine Halloween "mud art". Thank you.