

Muddy Card Responses Lecture M9

Why do the bars extend axially? Since the bars in a truss only carry axial forces and have a constitutive law $\Delta = FL/AE$ (i.e. Hooke's law) the extension of the bar must be aligned with the direction of the bar. In addition there is a rotation.

How are the displacement diagrams useful? Are they just to visualize relative movements They not only allow one to quantify the relative movements, but also to quantify them as well. If you draw the displacement diagram accurately you can measure the displacements of it. Or use trigonometry to calculate the displacements.

It might be easier to follow displacement diagrams if you drew it in class. It was a lot easier to understand when I just imagined deriving it. Good point. I think that this is one of those techniques that looks a bit intimidating, but is actually quite straightforward when you apply it.

Is it necessary to draw the displacement diagram you made to solve for point displacements? Is it more helpful than confusing? Obviously I think that it is helpful otherwise I would not be doing it!. As mentioned above, if you actually try to work out a problem using it I think that you will find that it is not as bad as it looks.

In the problem that we did in lecture today did $AE=1$ for all of the bars. Sort of, in the notes I normalized all the bar extensions by PL/AE – so that they were just numbers. I could have set $AE=1$, but this would have been less physically realistic.

I didn't understand 100% how to draw a deflection diagram when starting up. The ?????? (illegible). We will do a little more on this in class today and there are a couple of homework problems to allow you to practice further.

No mud. For the test next Friday are we going to cover block 1 only, or will we cover all the lectures up until the test? No just block 1 – i.e today's lecture, and the material covered in this week's homeworks (i.e. to M10).

Last PRS: Why can't you take a moment about one of the pins instead of the joint? Since all the bars (and bar forces) pass through joint D, there is no additional information to be gained by taking moments – try it for yourself.

I am confused about Monica's question? What did you mean about supporting moments? Not all structures are pin-jointed trusses. If the bars are not joined by pin joints the joints can transmit moments, and the bars will carry moments and therefore bend. This is not allowed in a pin jointed truss, so we cannot use clamp supports (which support moments) to support a truss. When we meet beams next term, we will start using clamped supports.

What does "collinear" with the bars mean? "aligned with" . I.e. the reactions are aligned along the bars.

What is a constitutive law. In the broadest sense this is a law (equation, relationship) that relates cause and effect. $V=IR$ could be thought of as a constitutive law relating the voltage to

the current flowing through a resistor. In M&S a constitutive law relates forces and displacements, or displacements and temperatures, (and we will see over the next few lectures, stress and strain).

Don't understand diagram. We will do a little more on this in lecture today. Do come and ask if it still does not make sense.

I don't understand how to read the displacement diagram (several on this theme) See above comment..

No mud, just need to try it on my own. That's the spirit!

By drawing displacements will we find answers that have enough accuracy. Absolutely, with just a little care in the drawing you can be accurate to 2 significant figures, which is perfectly good enough. Given that we probably cannot measure material properties to better than 1% and they may vary by 1-10%, 2 sig figs is pretty good!

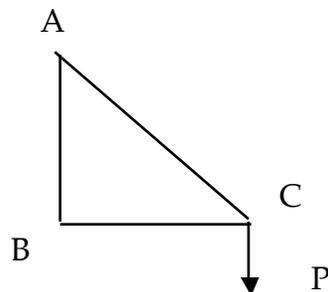
Are A and B both treated as one point on the diagram? Why can we do that? Will we be making displacement diagrams on our problem sets? A and B are both fixed, so they do not move. The key concept behind the displacement diagram is that the diagram plots relative displacements (i.e. from the original, unloaded, position of the joints). You will get a chance to practice on the current set of problem set questions.

Still a bit fuzzy about displacement diagram. Could we do a recitation example where we draw one starting from scratch? Thanks! We will do a bit more in lecture today, and then some in next week's recitation.

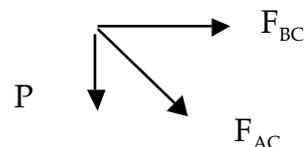
No mud, just not clear about how the diagram would look if you started from a different origin. We can talk about this in recitation, or in office hours next week. This is not a key issue at this time.

When calculating d , how did you determine AE in the FL/AE equation? I'm also unsure about how the displacement diagram relates to the original position of the joints? AE are the cross sectional area and Young's modulus of the bars – which you would know. I just kept them as symbols to allow you to see where they entered the calculation.

If I have a truss like:

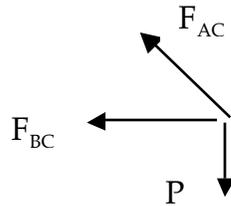


And apply method of joints at C:



And solve for the forces, if F_{AC} turns out to be negative, is it in tension or compression?

In my mind you have chosen a slightly strange way to draw the joint. While it is technically correct (it is just the line of action of the force that matters in applying equilibrium) it would be clearer if you drew your joint:



Now the bar forces are pulling in the direction of the bars themselves. As drawn the bar forces are tensile, if F_{AC} turns out to be negative then it would be in compression. In fact F_{AC} is tensile and F_{BC} is compressive.

How do you know where to start (which point) in calculating deflections? It is usually easiest to start calculating the point which is attached by bars to two points with known (or fixed deflection). In the cantilever trusses we have been looking at this is straightforward, but it is still possible when you have a bridge like structure in which the two known (fixed) points are not connected by a single bar.

What is the numerical method that is equivalent to the graphical method of solving for displacements. It would be a representation of the graphical method. I.e. each joint displacement would be divided up into components due to bar extensions parallel to the direction of the bar and rotations that are represented by displacements perpendicular to the axis of the bar (for small deflections).

Regarding the example done in lecture: After knowing that points A and B are fixed, we solve for the relative displacement of point D. But isn't point D affected by the bar forces in CD and ED? Also, in addition to AD and BD? Why can we neglect these forces acting on point D in our analysis. Good question. Firstly, when we solve for the displacements we have converted the bar forces into extensions/contractions, so it is the bar extensions/contractions that we need to worry about rather than the bar forces. Given that we know what the bar extensions are, and that points A and B are fixed, this uniquely defines where point D must be. Of course the displacement of D must be compatible with the bar extensions of CD and ED, but this is surplus information in terms of locating D. Instead we can use these compatibility conditions to determine where C and E must displace to.

So since we like to do things in an x-y coordinate system. Should we always choose our starting point for the displacement diagram to be a horizontal or vertical bar? Is that basically always easiest? You do not have to do this, but it will probably end up easiest if you choose a coordinate system aligned with the structure so as to make your calculations easier.

I'm sorry but I am quite lost. If you are still lost at the end of lecture, please come and talk to me

Also 14 cards indicating no mud.