Engineering Mechanics
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Dynamics of rigid bodies

So let's look at some more problems. We will just identify some of those things that we know. Let's take the three bar link. So let's say I have something like this. This is a three bar link pinned over here. Let's say the dimensions are given. So let's say l_1 this is A, so l_{AB} is given. This is C, this is D. Let's say the angle is given here, this is l_{BC}. Let's say the angle is given. Now given this kind of a problem lets say and given that the angular velocity of this is $omega_{A\ B}$. Let's say I need to find out the angular velocity of B C and angular velocity of C D, that's the problem. How will I go about doing it?

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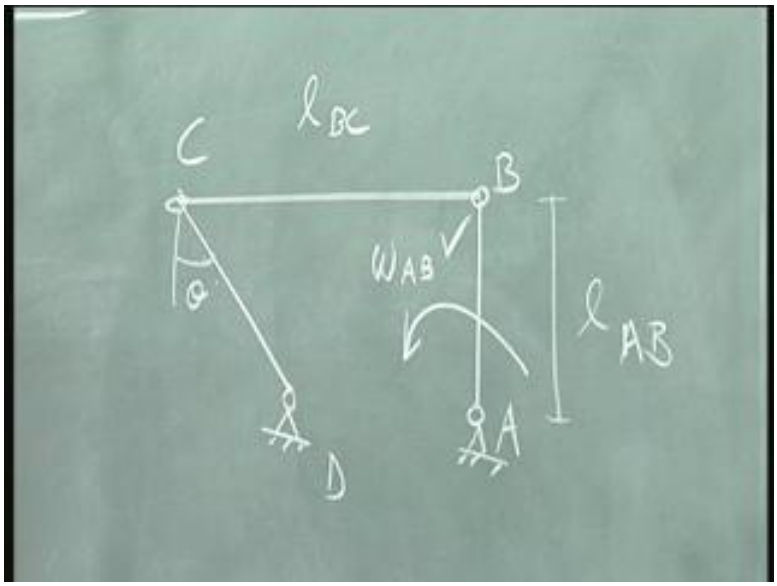

Now remember angular velocity of l_{BC} is related to velocity of B and velocity of C. Angular velocity of C D is related to since the velocity of D is zero, it is related to C. So lets look at it from that point of view. I have like this. This is A. Remember this is pinned to the fixed frame which means what is the direction of velocity over here? The direction of velocity is already known to be like this. This is $omega_{A\ B}$. Now the other is this, this is B. Do I know the velocity of this B? Yes, because this velocity of B is known, this velocity is known. What is this velocity? It is omega times this length. The direction is known, so this is known.

Looking at C D, again this is equal to zero. This I can now spot, supposing this is the angular velocity of C D then I know the direction of the velocity at C should be like this. How about this point? Since this point and this point are the same, this also has to have a direction which is perpendicular to C D. Do I know the direction of C D? The answer is yes which means the direction of V_C is already known. What do I don't know? Since

omega$_{C\,D}$ is not known, omega$_{C\,D}$ times the length is not known. Once I know omega C D since I know the length, I can find out the magnitude of V_C. Now looking at this C B, I know V_C is equal to V_B plus omega$_{B\,C}$ cross $r_{B\,C}$. V B is a direction, supposing i need to find out only this component, this component is in what direction? That's very simple. that component is along this direction. Remember I am talking about component of V_C. Component of V_C is this which is omega$_{B\,C}$ times $r_{B\,C}$. direction is along this. The rest of it has to be like this. V_B is known, now this is perpendicular to it.

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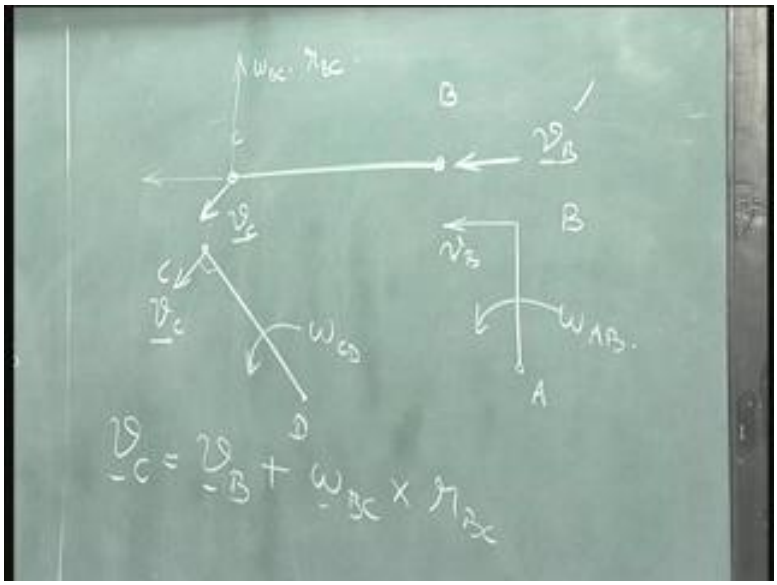

So if I have to find this direction, it is the component of V_C along this direction that I need to find out. Once I do that then I can use this relationship to find out omega$_{B\,C}$. remember direction known here, magnitude not known. Magnitude is related to omega$_{C\,D}$. In the other if I take two different directions, I can write two different equations. One direction will involve B C, the other will not. The other which will not will help me solve for the magnitude of V_C and therefore I can solve. As simple as that. What did I do here? I could find out the direction of this point C, velocity direction of this point C, velocity direction of point B. Knowing these it was possible for me to find out the other quantities related to it.