Engineering Mechanics
Prof. Siva Kumar
Department of Civil Engineering
Indian Institute of Technology, Madras
Dynamics of rigid bodies

Let's look at another problem so that we can get familiar with some of these problems. Here let's say the rod A B is rotated, link A B is rotated by moving this bar or block along a slot. This slot is actually fixed to the fixed frame. so this can move up and down, what ever and we need to find out the angular velocity of A B. is the geometry given? Yes, at a particular location, at a particular configuration of this let's say the quantities are given. What are the quantities? The length of A B, the length of B C and the angle at the instant of what we want to find out, let's say are given which means the entire geometry is given. The direction of V_C is fixed as you can see here. This is the constraint.

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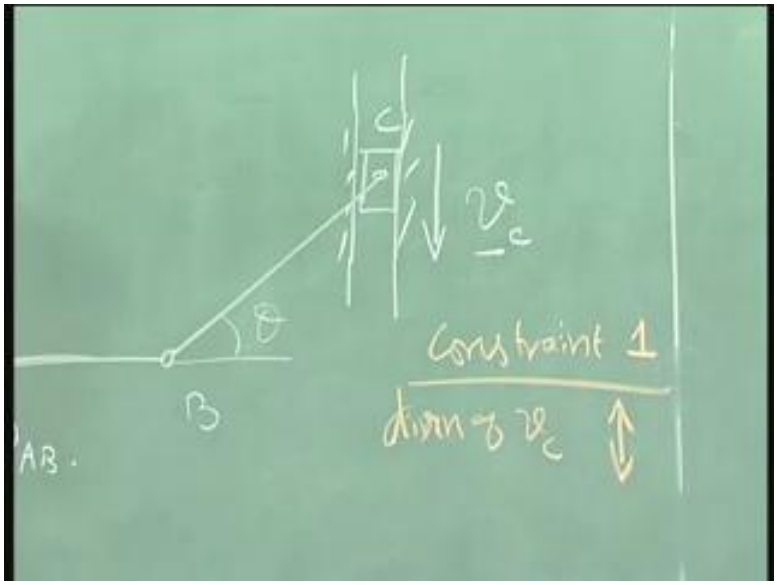

If you can identify the constraint, constraint number one what is that? Direction of V_C is vertical that's something we know. The velocity of this is let's say given, we will come to that. Before that we will identify the constraints. What is the other constraint? Constraint number two is if you look at this point A, it is fixed to the fixed frame. So V_A equals acceleration of A equals zero. Correct, that's another constraint given. Any other constraint? If you look at B, the constraint of B is such that the velocity of, so that's the next constraint, constraint three that connects these two bodies. What is that? Velocity of B with respect to seeing B_C should be same as the velocity of B as I see from A B.

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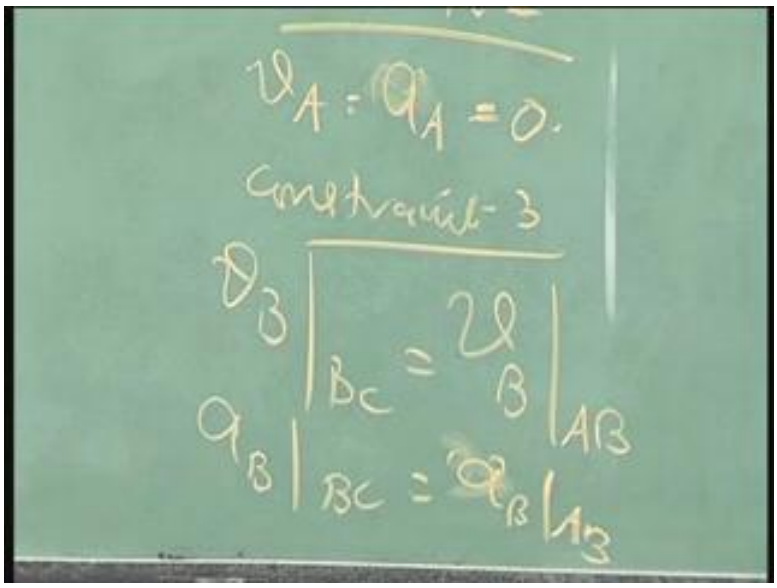

It is true with acceleration also. Once I understand these constraints, now it is very easy. I need to find out lets say the angular velocity of rod A B. How will I go about? Very simple. This has an angular velocity which means what? This particular point will be moving like this. Do you get this? This is horizontal, this will be moving vertically upward. So let's look at B C. B C is like this, this direction is given to be like this, this is V C. What do we know about this point B looking at A B? It is perpendicular to the direction A B so which is this direction.

What is the value of this velocity at B? What do you know about that? Very simple, we did this in the tip number 7 or 8, I don't remember. If this direction is known and this direction is the same as this direction, what will be the velocity of this? It is the same velocity as this. So immediately I will write V_B velocity is equal to V_C velocity. In fact I can remove this because the direction was also the same. V_B and V_C move parallely at this configuration. Please remember that it is that configuration that I am talking about. Now it's very simple, V_B is given to you. How do I find out omega A B? That's very simple omega cross $r_{A\,B}$ is $omega_{A\,B}$ and problem is solved immediately because r omega times this direction is equal to V_B is equal to V_C. Is this given? The answer is yes.

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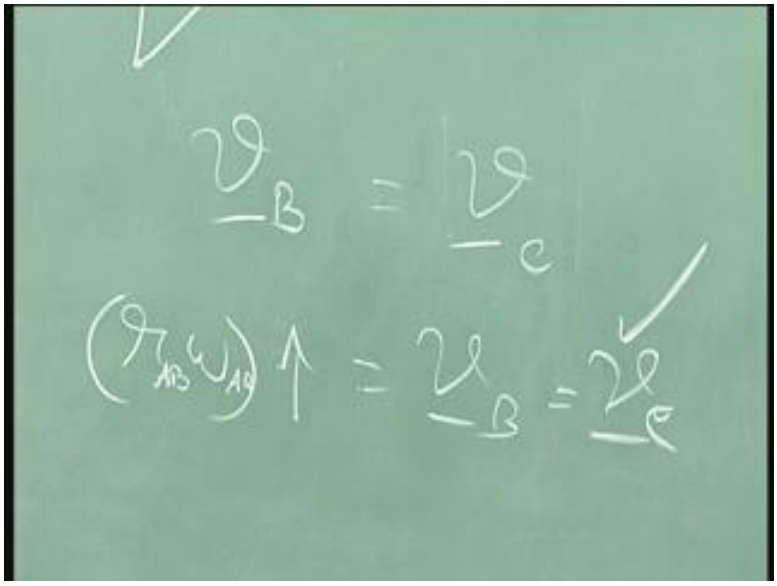

So r omega is given, r is known, omega can be found out. Just to make it very clear, $r_{A\,B}$ times $omega_{A\,B}$. Look at the way in which we have solved this problem. We are looking at it in a very simple way and trying to see if we can solve the problem. If the velocity is downward, I should assume a downward direction. Notice that this is actually r omega w, r omega in the upward direction. If I have to equate it to downward direction, I will have a negative sign coming in or in other words omega will become clockwise instead of anticlockwise. Signs will automatically match the moment I have the directions properly understood. Remember if it is rotating like this with an angular velocity $omega_B$, the velocity of V_B will be along this and the direction is omega r times this vectorial direction. Clear? This is as simple as that.