

ME 2580 Example #34b: (Rigid Body Kinematics – Instantaneous Centers)

Given: - four-bar mechanism $ABCD$

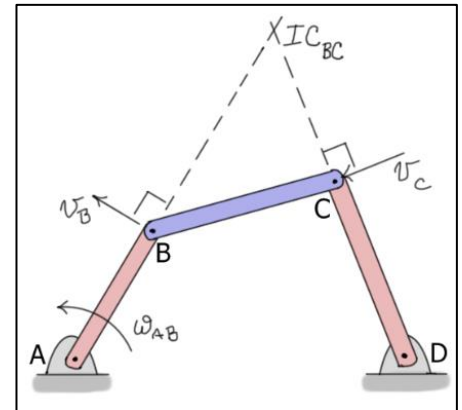
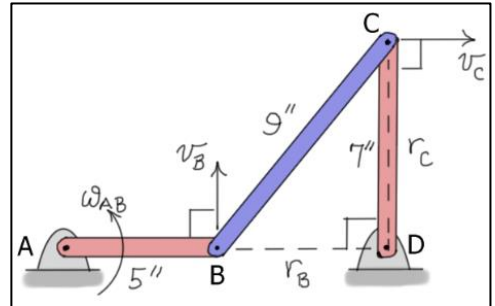
$$\omega_{AB} = 5 \text{ (r/s)}$$

Find: ω_{BC} , ω_{CD}

Solution:

Consider the general four-bar mechanism shown in the second diagram. To find the instantaneous center (IC) of the connecting link BC , construct lines that are perpendicular to the velocities of both B and C . These lines which are along the links AB and CD intersect at the IC of BC .

Using this approach on the given four-bar mechanism, the IC of the connecting link BC is found to be at point D at the instant shown. Using this observation, write



General Configuration

$$v_B = r_{AB} \omega_{AB} = r_B \omega_{BC} \Rightarrow \omega_{BC} = \left(\frac{r_{AB}}{r_B} \right) \omega_{AB} = \left(\frac{5}{\sqrt{9^2 - 7^2}} \right) 5 = 4.41942 \approx 4.42 \text{ (r/s)}$$

$$v_C = r_C \omega_{BC} = r_C \omega_{CD} \Rightarrow \omega_{CD} = \left(\frac{r_C}{r_C} \right) \omega_{BC} \approx 4.42 \text{ (r/s)}$$

Given the velocity of B is upward, the velocity of C must be to the right. Hence, the angular velocities of links BC and CD must both be clockwise. So, at the instant shown,

$$\omega_{BC} = \omega_{CD} = -4.42 \hat{k} \text{ (r/s)}$$