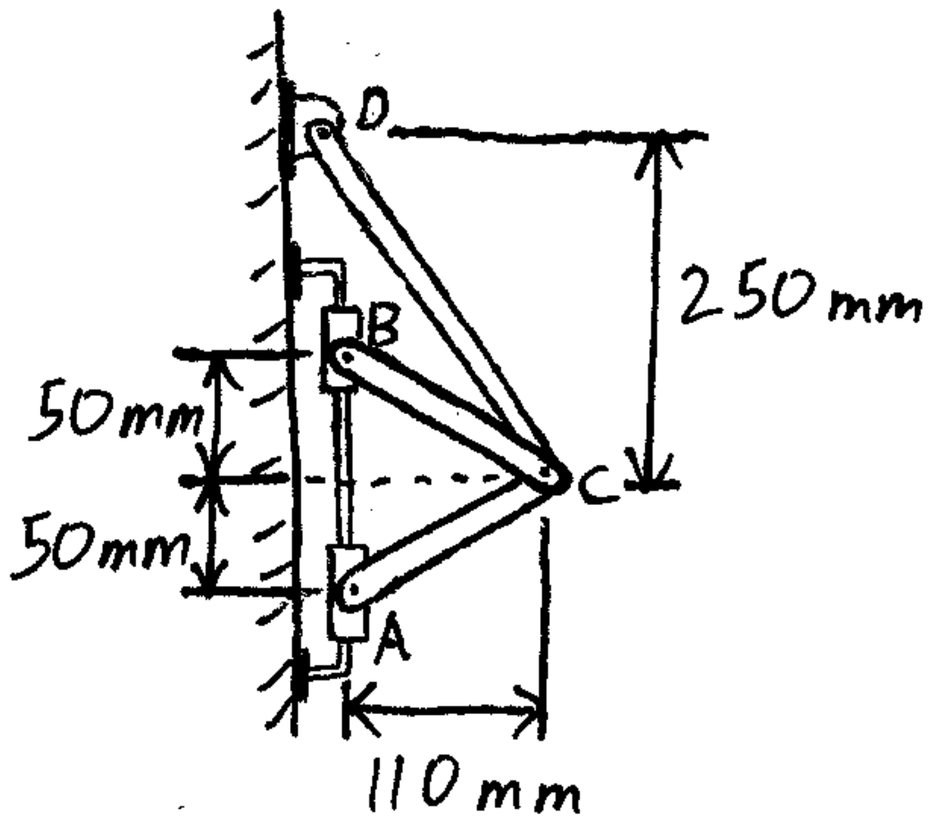
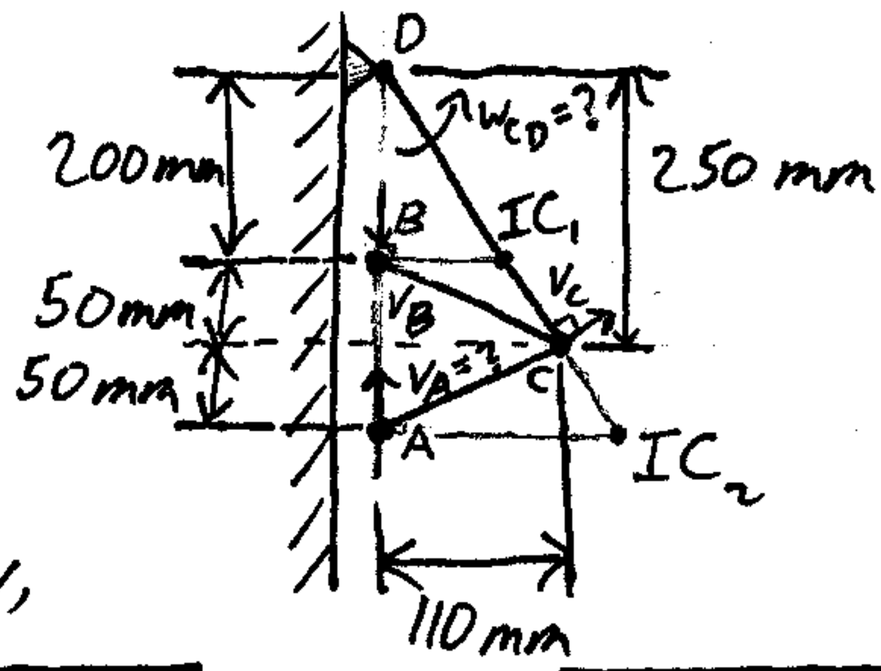
This is a problem involving instant center (engineering mechanics).



In the assembly shown, A and B are collars which are free to slide along the vertical rod shown. The velocity of collar B is 520 mm/s in the downward direction. Calculate (a) the velocity of collar A, and (b) the angular velocity of link CD.

Solution:



Point B moving downward causes point C to move towards the right. This then causes point A to move upward

By geometry,

$r_{BC} = \sqrt{50^2 + 110^2}$
$= 120.83\,mm$
$r_{AC} = 120.83\,mm$

$r_{CD} = \sqrt{110^2 + 250^2}$
$= 273.13\,mm$

By similar triangles, $\frac{r_{B/IC_1}}{200} = \frac{110}{250}$

$r_{B/IC_1} = 88\ mm$

By similar triangles,

$$\frac{r_{CD} - r_{C/IC_1}}{200} = \frac{r_{CD}}{250}$$

$$\frac{273.13 - r_{C/IC_1}}{200} = \frac{273.13}{250}$$

$$r_{C/IC_1} = 54.626\ mm$$

$$w_{BC} = \frac{V_B}{r_{B/IC_1}} = \frac{520}{88} = 5.909\ rad/s \circlearrowleft$$

$$V_C = w_{BC}\, r_{C/IC_1} = (5.909)(54.626) = 322.8\ mm/s$$

$$w_{CD} = \frac{V_C}{r_{CD}} = \frac{322.8}{273.13} = 1.18\ rad/s \quad \text{(answer for (b))}$$

By similar triangles,

$$\frac{r_{A/IC_2}}{200+50+50} = \frac{110}{250}, \quad r_{A/IC_2} = 132\ mm$$

By geometry, $r_{D/IC_2} = \sqrt{300^2 + r_{A/IC_2}^2}$

$$= \sqrt{300^2 + 132^2}$$

$$= 327.756\ mm$$

$$r_{C/IC_2} = r_{D/IC_2} - r_{CD} = 327.756 - 273.13$$
$$= 54.626 \text{ mm}$$

$$w_{AC} = \frac{v_C}{r_{C/IC_2}} = \frac{322.8}{54.626} = 5.909 \text{ rad/s} \curvearrowright$$

$$v_A = w_{AC}\, r_{A/IC_2} = (5.909)(132) = 780 \text{ mm/s} \uparrow$$

(answer for (a))