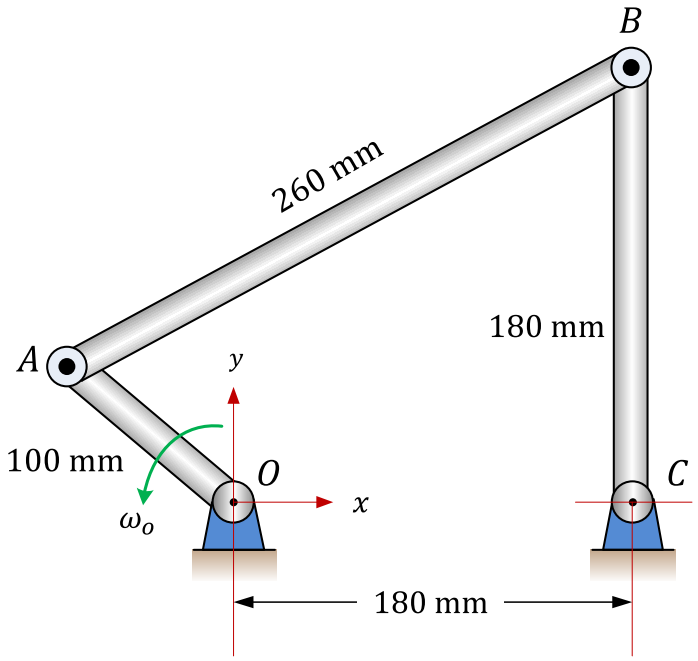
MMAN2300 Engineering Mechanics 2
Part B: Rigid Body Dynamics
Problem solving session – 1
WEEK 7_S2_2018

Question 1:

In the four-bar linkage shown, control link *OA* has a counter clockwise angular velocity $\omega_o = 8$ rad/s during a short interval of motion. When link *CB* passes the vertical position shown, point *A* has coordinates $x = -60$ mm and $y = 80$ mm. By means of relative velocity analysis, determine (a) the angular velocity of *AB*, and (b) the angular velocity of *BC*.



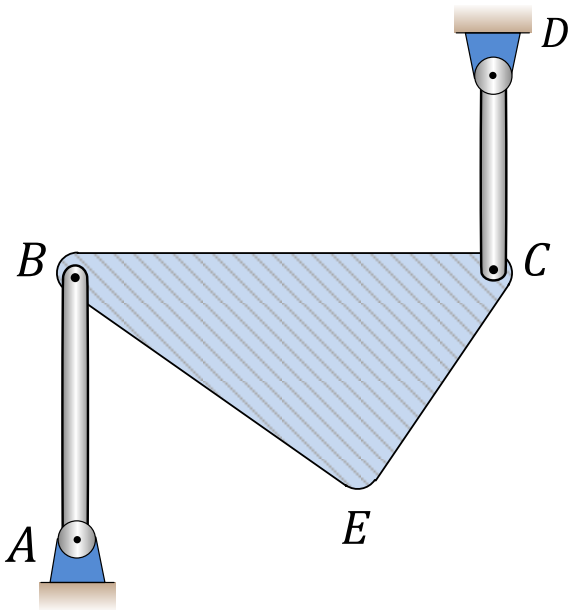
[$\omega_{AB} = 2$ rad/s CCW; $\omega_{BC} = 4.67$ rad/s CCW]

Questions 2 & 3

The mechanism shown in the figure below has rigid links pivoted at *A*, *B*, *C* and *D*. The link *BCE* is a rigid plate. The dimensions of the links are:

AB = 80 mm
BC = 100 mm
BE = 80 mm
CE = 60 mm
CD = 40 mm

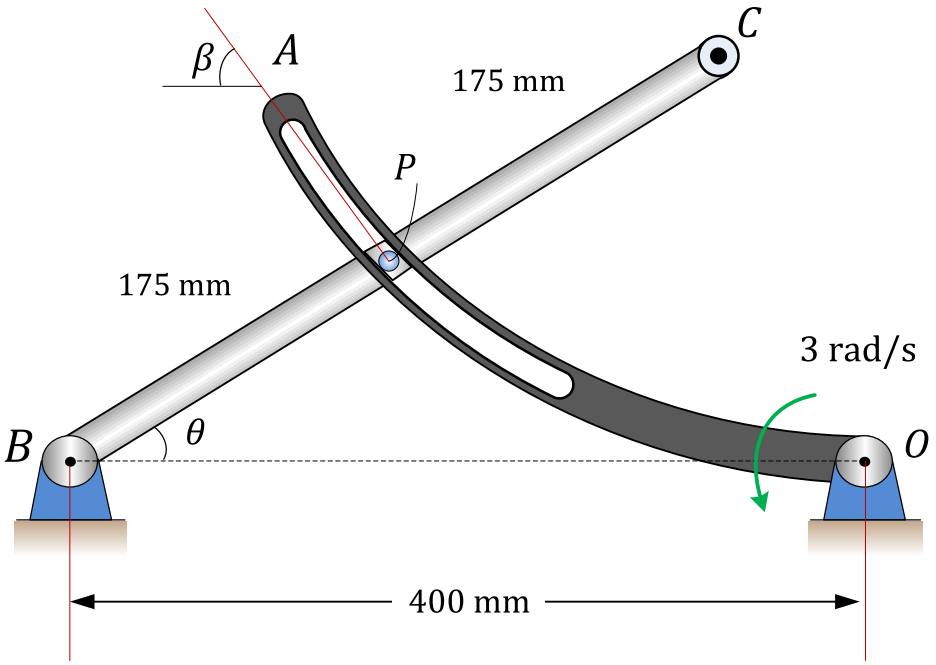
At the instant when both angles *ABC* and *BCD* are 90°, the link *AB* has a clockwise angular velocity of 2 rad/s. Determine the angular velocities (magnitude and direction) of links *BCE* and *CD*.



$[\omega_{CD} = 4 \text{ rad/s CCW}]$

Questions 4 & 5

The mechanism is designed to convert from one rotation to another. Rotation of link *BC* is controlled by the rotation of the curved slotted arm *OA*, which engages pin *P*. For the instant represented θ = 30° and the angle β between the tangent to the curve at *P* and the horizontal is 40°. If the angular velocity of *OA* is 3 rad/s for this position, determine the velocity of point *C*.

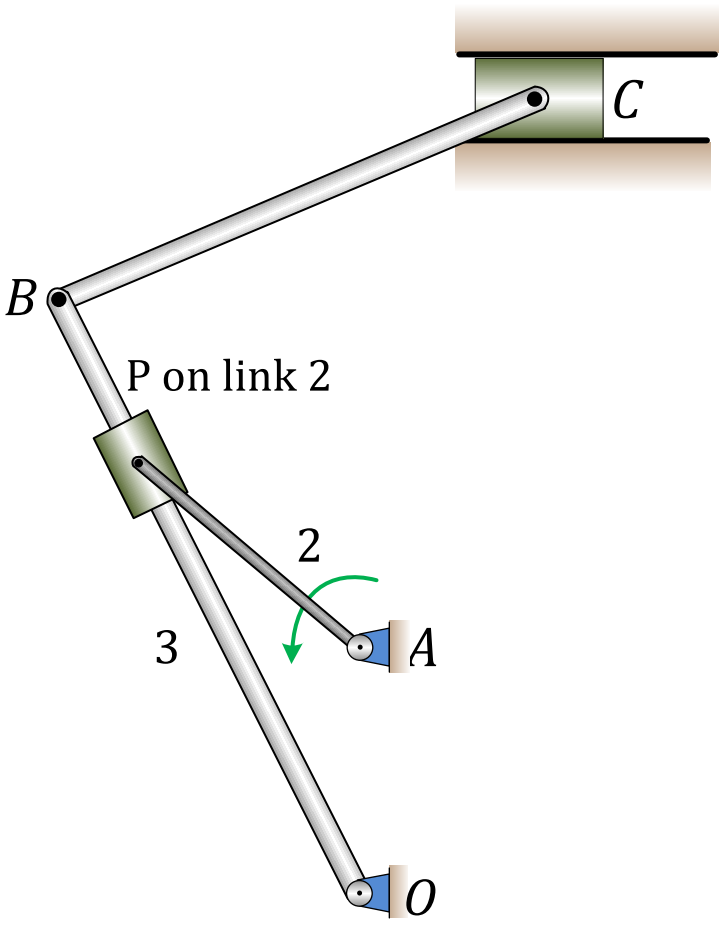


$[v_C = 4.32 \text{ m/s}]$ ↘

Questions 6 & 7

The diagram shows part of a quick-return mechanism. Link 2 (*AP*) has an angular velocity in the direction shown of 3.4 rad/s and *AP* and *AO* are the same length (470 mm). Link 3 (*OB*) is constrained to move within the slider attached to link 2.

Find the magnitude of the velocity of C if *OP* = 658 mm, *OB* = 921.2 mm and *BC* = *OB*. At this instant *BC* is perpendicular to *OB*.



$[v_C = 2.24 \text{ m/s}] \leftarrow$