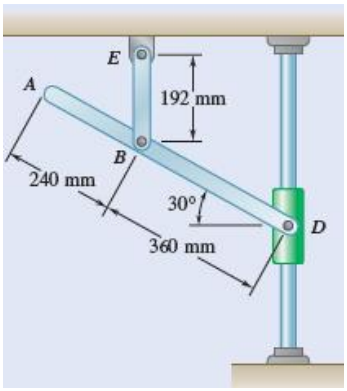
Quiz 12: Chapter 16

Due: Friday 03 March 23

Examine the solved problem below. There are four errors in the solution below. Your task is to locate and identify those errors, then correct them and calculate the proper result. If the same error occurs more than once, only count it as a single error, even if you have to correct it in more than one instance.

Each correctly identified error is worth 4 points, and the re-calculated results are worth 4 points as well. You must save your work in pdf format and submit via the Quiz 12 Assignment in the Chapter 16 folder in the Quizzes folder of the Online Classroom in Blackboard. Please do not use any other file format than pdf.

At the instant shown the angular velocity of rod BE is $\omega_E = 4\frac{\text{rad}}{\text{s}}$ counterclockwise. Use the instantaneous center of rotation method to determine the angular velocity ω_{AD} of rod AD, the velocity v_A of the end of the rod, and the velocity v_D of collar D at this instant.

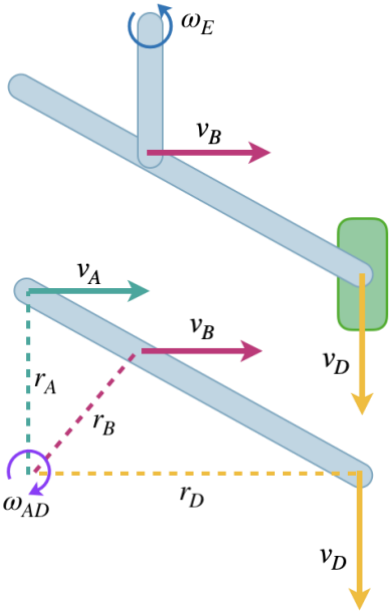


A) Calculate the velocity v_B of point B using the rotation of rod BE.

$$v_B = \omega_E r_{EB} = \left(4\frac{\text{rad}}{\text{s}}\right)(0.192\text{m}) = 0.768\frac{\text{m}}{\text{s}}$$

B) Geometrically locate the instantaneous center of rotation of rod AD and calculate the distances r_A, r_B, and r_D to the IC.
See figure on the right.

$$r_A = (0.240\text{m} + 0.360\text{m})\cos 30° = 0.520\text{m}$$
$$r_D = (0.240\text{m} + 0.360\text{m})\sin 30° = 0.300\text{m}$$
$$r_B^2 + (0.240\text{m})^2 = r_A^2$$
$$r_B = \sqrt{(0.520\text{m})^2 - (0.240\text{m})^2} = 0.461\text{m}$$



C) Use the velocity v_B to find the angular velocity ω_{AD} of rod AD.

$$v_B = \omega_{AD} r_B = \omega_{AD}(0.461\text{m}) = 0.768\frac{\text{m}}{\text{s}}$$
$$\omega_{AD} = \left(0.768\frac{\text{m}}{\text{s}}\right)(0.461\text{m}) = 0.354\frac{\text{rad}}{\text{s}}$$

D) Find the velocity v_D of collar D at this instant.

$$v_D = \omega_{AD} r_D = \left(0.354\frac{\text{rad}}{\text{s}}\right)(0.300\text{m})\sin 30° = 0.0531\frac{\text{m}}{\text{s}}$$

E) Calculate v_A:

$$v_A = \omega_{AD} r_A = \left(0.354\frac{\text{rad}}{\text{s}}\right)(0.520\text{m})\cos 30° = 0.159\frac{\text{m}}{\text{s}}$$