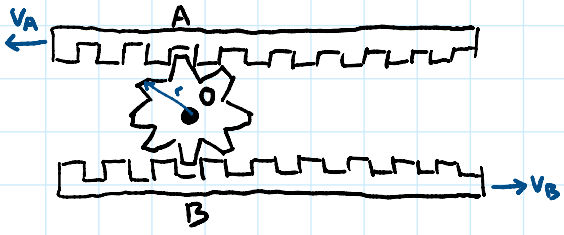
20-R-KM-DK-14

July 31, 2020 11:26 AM



20-R-KM-DK-14 Beginner ICZV

Inspiration: Hibbeler Example 16.11

A gear sits between two moving racks. If the top rack moves at a velocity of ***v_A = 0.8 m/s*** to the left and the bottom rack moves at a velocity of ***v_B = 0.45 m/s*** to the right, determine the velocity at the center of the gear, the angular velocity of the gear, and the distance to the ICZV from point B. The gear has a radius of ***r = 0.05 m***.

Let x be the distance from the ICZV to the rack

$v_B = \omega x = 0.45$ m/s

$v_A = \omega(2r - x) = \omega(0.1 - x) = 0.8$ m/s

$\omega = \frac{0.45}{x} = \frac{0.8}{0.1-x} \Rightarrow 0.045 - 0.45x = 0.8x \qquad x = 0.036$

$\omega = \frac{0.45}{0.036} = 12.5$ rad/s $\qquad r_{O/IC} = r - x = 0.05 - 0.036 = 0.014$

$v_O = \omega r_{O/IC} = (12.5)(0.014) = \boxed{0.175 \text{ m/s}}$