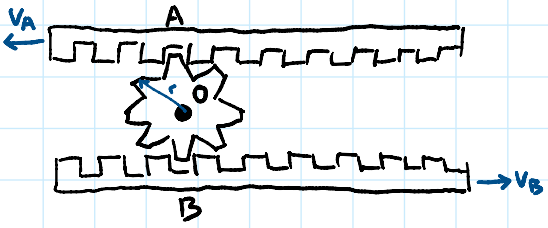
20-R-KM-DK-14

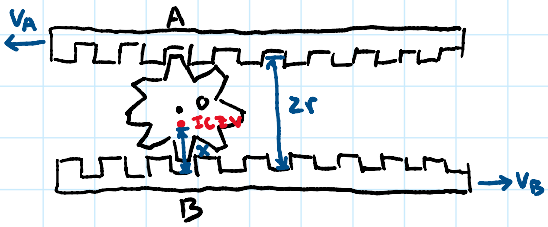
July 31, 2020 11:26 AM

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 magnitude of the velocity at the center of the gear, the magnitude of 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 B

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

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

$\omega = \frac{0.45}{x} = \frac{0.8}{0.1 - x} \Rightarrow 0.045 - 0.45x = 0.8x$ $\boxed{x = 0.036 \text{ m}}$

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

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