Problem 6.63

At the instant shown, the lower rack is moving to the right with a speed of 2.7 m/s while the upper rack is moving to the left with a speed of 1.7 m/s. If the nominal radius of the pinion \( O \) is \( R = 0.25 \) m, determine the angular velocity of the pinion, as well as the position of the pinion's instantaneous center of rotation relative to point \( O \).

\[
\tan(\theta) = \frac{2.7}{R_A} = \frac{1.7}{R_B}
\]

Also, \( R_A + R_B = 2R = 0.5 \) m \( \Rightarrow R_B = 0.5 - R_A \)

Then \( \frac{2.7}{R_A} = \frac{1.7}{0.5 - R_A} \Rightarrow \frac{0.5 - R_A}{R_A} = \frac{1.7}{2.7} = 0.6296 \)

\( \frac{0.5}{R_A} - 1 = 0.6296 \)

\( R_A = 0.3068 \) m

So, IC is 0.3068 m from A or 0.3068 - 0.25 = 0.0568 m from \( O \)

Find \( \omega \)

\[ V = wR \quad w = \frac{V}{R} \]

\[ w = \frac{V_A}{R_A} = \frac{2.7}{0.3068} = \text{distance from IC to } A \]

\[ w = 8.801 \]