

What is the tangential acceleration of a bug on the rim of a 10.0 in. diameter disk if the disk moves from rest to an angular speed of 75 revolutions per minute in 4.0 s?

Solution:

$d = 10.0 \text{ in} = 0.254\text{m}$ –diameter of the disk;

$v = 75 \text{ revolutions per minute} = \frac{75}{60} \cdot 2\pi = 7.85 \frac{\text{rad}}{\text{s}}$ –angular speed of the disk;

$t = 4\text{s}$ – time that disk need to move from rest to an angular speed.

Angular acceleration of the disk is:

$$a_{\text{ang}} = \frac{v}{t} = \frac{7.85 \frac{\text{rad}}{\text{s}}}{4\text{s}} = 1.96 \frac{\text{rad}}{\text{s}^2}$$

Tangential acceleration of the disk:

$$a_{\text{ang}} = \frac{a_{\text{tan}}}{r} \Rightarrow a_{\text{tan}} = a_{\text{ang}} \cdot r = a_{\text{ang}} \cdot \frac{d}{2} = 1.96 \frac{\text{rad}}{\text{s}^2} \cdot \frac{0.254\text{m}}{2} = 0.25 \frac{\text{m}}{\text{s}^2}$$

Answer: Tangential acceleration of the disk is $0.25 \frac{\text{m}}{\text{s}^2}$.