

# EE361 Microcomputer-Based Digital Design

## Quiz 3 Solution

OPEN BOOK, OPEN NOTES.

Name: \_\_\_\_\_

Section: \_\_\_\_\_

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1. Figure 1 shows a wheel rolling in a clockwise manner along a horizontal surface, from left to right. The radius of the wheel is  $r = 3$  cm. The wheel is driven by a stepper motor under control of a PIC16F884. The stepper motor gives 720 steps/revolution. The processor drives it using half-step control.

What is the required period required between successive half-steps to make the wheel advance with a velocity  $v = 40$  cm/s?

SOLUTION

We need a rotational velocity of

$$\begin{aligned}\omega &= \frac{v}{2\pi r} \\ &= \frac{40 \text{ cm/s}}{2\pi(3 \text{ cm/revolution})} \\ &= 2.12 \frac{\text{revolution}}{\text{s}}.\end{aligned}$$

With 720 steps/revolution, there are  $r = 1440$  half-steps/revolution, so we need

$$\begin{aligned}n &= \omega r \\ &= \left(2.12 \frac{\text{revolution}}{\text{s}}\right) \left(1440 \frac{\text{half-steps}}{\text{revolution}}\right) \\ &\approx 3056 \frac{\text{half-steps}}{\text{s}}.\end{aligned}$$

The reciprocal of this gives the required period:

$$\begin{aligned}T &= \frac{1}{n} \\ &= \frac{1}{3056 \text{ half-step}} \text{ s} \\ &\approx \frac{327 \mu\text{s}}{\text{half-step}}.\end{aligned}$$

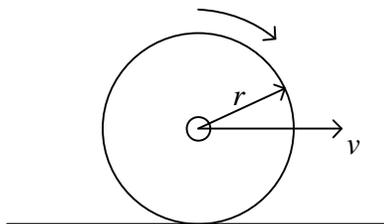


Figure 1: A Rolling Wheel