Today, we will:
- Do some more example problems – rotation rate and stroboscopic tachometers
- Finish the pdf module: Mechanical Measurements – Torque, and do some examples

**Example: RPM measurement**

**Given**: A wagon wheel has 12 identical spokes, and rotates at 600 rpm. The rpm is measured with a stroboscopic tachometer in a room where it is dark except when the strobe light flashes. There are no painted dots anywhere, and there is no way to distinguish one spoke from another.

**To do**: Calculate the maximum strobe flashing frequency at which you could be fooled. In other words, calculate the maximum strobe flashing frequency at which you would see a wagon wheel that appears to be frozen (not rotating), and therefore you could be fooled into thinking that this is the correct rpm. *Give your answer as in integer in units of rpm.*

**Solution:**

![Diagram](image)
Example: RPM of car tire

Given: A car travels at 40 miles per hour. The outer diameter of its tires is 28 inches.

To do: Calculate the rotation rate of the wheel in units of rpm (rotations per minute).

Solution:
Example: RPM measurement

Given: A white dot is painted on the shaft of a turbine. The shaft starts rotating at 860 rpm. Its rotational rate is measured by a stroboscopic tachometer.

(a) To do: Name at least two strobe settings (rpm) at which the strobotachometer would give a false reading of rotation rate (you are fooled).

Solution:

(b) To do: For the setup shown here, are there any strobe settings greater than 860 rpm at which the strobotachometer would give a false reading of rotation rate? Explain.

Solution:
Example: Dynamometer measurement

**Given:** Gerry is building a prony brake dynamometer to measure the torque output from a small (100 mL displacement) motorcycle engine. The maximum expected torque is 7.0 N·m, at a rotation rate of around 7500 rpm. Gerry has a fish-scale-type force gage with a range of 0 to 50 N. He would like to use this scale in his dynamometer.

(a) **To do:** Calculate the moment arm that Gerry should build for his dynamometer.

**Solution:**

(b) **To do:** Gerry tests the engine and finds that its maximum power output is 8.1 hp at 8500 rpm. Calculate the torque at this maximum-power operating condition.

**Solution:**
Example: **Dynamometer measurement**

**Given**: A prony brake dynamometer is used to test the output of a small engine:

- moment arm \( r = 11.30 \text{ cm} \pm 0.05 \text{ cm} \) (measured with a ruler)
- force \( F = 36.5 \pm 0.5 \text{ N} \) (measured with a fish scale)
- rotation rate of the engine shaft \( N_{\text{rpm}} = 2012 \pm 1 \text{ rpm} \) (measured with a strobotach)

All measurements are to standard engineering (95%) confidence level.

**To do**: Calculate the engine shaft power (in units of watts) and its uncertainty.

**Solution**: 

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