

**ECEN 5053-003 Homework Assignment**

Course Name: Embedding Sensors and Actuators

Corresponding Module: C1M3

Week Number: 3

Module Name: Rotary Sensors

Homework is worth 100 points. Each question is worth 10 points.

1. A spool cutting machine with spool diameter of 0.25 meters cuts a piece of fabric 7 meters long. How many revolutions would the absolute encoder measure?
2. An absolute encoder is mounted to the motor driving the X-axis lead screw of a CNC milling machine. If the encoder has a spec of 1500 PPR, a lead of 1 mm, and the lead screw moves a distance of 200 mm, how many revolutions of the lead screw will the encoder count and what is the resolution of the X-axis?

1. An encoder has an input voltage of 24 volts and a transformation ratio of 0.475. What is the output voltage in volts?

D. Your resolver has a maximum tracking rate of 26 revolutions per second (rps) and gives rotational accuracy of 12 arc minutes. If you need a rotational accuracy of 0.25 degrees and your motor shaft rotates at 1750 rpm, can you use your resolver? Why or why not?

1. A two-channel encoder counts the leading and trailing edges of the pulse trains of its two channels. Suppose the resolution of a single channel encoder is 400 PPR. If you add a second channel to the encoder, and change no other specs, how much can you improve the resolution of the encoder?
2. A multiple speed resolver has 16 sets of secondary windings. Relative to a single speed resolver of the same basic design, how many times more accurate will it be?
3. Explain how a resolver determines angular position.
4. What is the transformation ratio for a resolver? What aspects of the resolver determine this ratio?
5. What are the four impedances that a resolver exhibits? How are these impedances represented in a resolver?
6. Why is an encoder’s performance stated in terms of resolution, as opposed to accuracy? How does the repeatability of the encoder compare to its resolution?