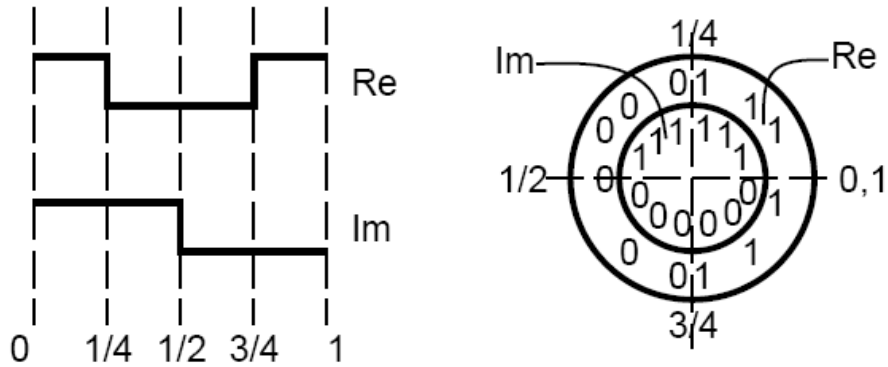


# CS545 Homework #1

## Question 1

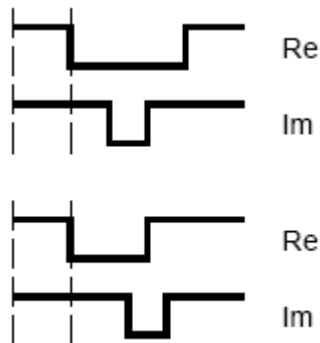
We have the following shaft encoder composed of two labels, the inner label Im and the outer label, Re as shown in the following figure.



The waveform on the right side show the output signal from this encoder.

- a) Can the output of this shaft encoder be used to determine the direction of rotation? If yes, how?

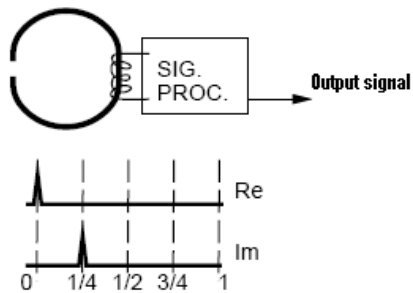
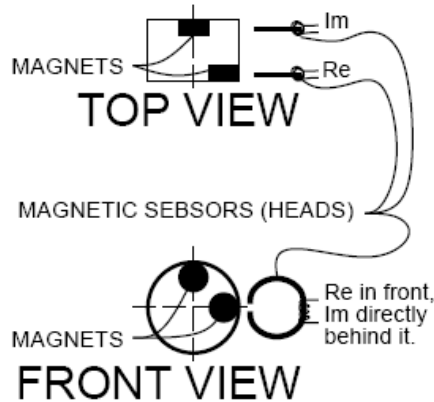
- b) We have placed two of these shaft encoders on two wheels of a robot. What can be said regarding each wheel?



Wheel 1:

Wheel 2:

C) The optical shaft encoders are fairly expensive. Thus we decided to use cheap magnets and magnetic sensors (like the head of record and playback tapes). When the magnet passes by the magnetic sensor, it creates a pick on the sensor, as shown in the figure below. To make a magnetic shaft encoder, the magnets are placed with 90 degrees angle difference on a wheel (front view), one on the inner side of it and one on the outer side of it (top view). Can this configuration be used to determine the speed and direction of rotation reliably?



**Question 2.**

Problem 1-13 in the textbook

**Question 3.**

Problem 1-18 in the textbook

**Question 4.**

Problem 2-6 in the textbook

**Question 5.**

Problem 2-15 in the textbook