

# Mechatronic Systems Design

## HW2

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### PROBLEM1

The higher the primary excitation frequency is, the more precise resolution will be. If the frequency is not higher enough, it will be mixed with the core motion.

The cut-off frequency of the low-pass filter must be chosen carefully to preserve core motion info and discard frequency induced by rectified wave.

### PROBLEM2

1. It usually consists of a rotating shaft(rotor) with a primary winding and a stationary housing(stator) with two secondary windings offset by  $90^\circ$ .

When the primary is excited with an AC signal, AC voltages are induced in the secondary coils, which are proportional to the sine and cosine of the shaft angle. Thus, the real angle can be resolved using function like  $\theta = \text{atan}(V_s, V_c)$ .

2. Resolution, Excitation voltage, Excitation frequency, Input impedance, Output voltage, Phase shift, Maximum angular velocity.
3. Pros: Simple structure, Reliable, Robust, High precision.  
Cons: Analog output make it uneasy to resolve real angle.

4. High precision machine tool: monitor shaft angle.  
Power plant: monitor rotor status.  
Robot: detect ankle pose.  
Aircraft: monitor flap deflection angle.