

Control Exam

Arian

Hackford

1a) Measurements are the use of instrumentation to record a physical quantity such as; pressure, velocity, temperature, or displacement. The result can then be recorded.

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Monitoring is using results taken regularly or continuously to track changes in the resulting values.

b) The two types of error are:

Systematic error: Errors introduced by inaccuracies in the measurement system design or in the experimental methodology.

Random error: Errors introduced to the system via unexpected causes. Due to their nature they must be

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2a) Closed loop control systems include a measurement system that provides an error feedback to the control unit to adjust the correction element accordingly. An open loop system does not have this feedback loop and hence can only adjust based on the input value. Due to not needing a complex measurement system open loop systems are cheaper and less prone to failure. Instrumentation can include sensors for various physical characteristics and more complex control units.

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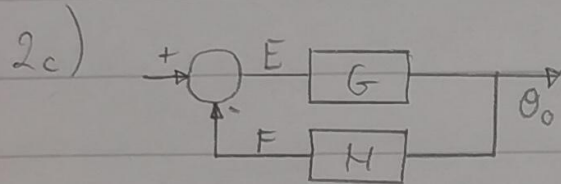
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2b) Proportional control strategies produce

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$$G = \frac{\Theta_o}{E} \Rightarrow E = \frac{\Theta_o}{G}$$

$$H = \frac{F}{\Theta_o} \Rightarrow F = H \times \Theta_o$$

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$$E = \Theta_i - F$$

$$\therefore \frac{\Theta_o}{G} = \Theta_i - H \times \Theta_o \Rightarrow \frac{\Theta_o}{G} + H \times \Theta_o = \Theta_i$$

$$\Theta_o \left(\frac{1 + G \times H}{G} \right) = \Theta_i$$

$$\therefore \frac{\Theta_o}{\Theta_i} = \frac{G}{1 + G \times H}$$

$$2d) \frac{\Theta_o}{\Theta_i} = \frac{5 \times 0.25}{1 + (5 \times 0.25 \times 0.15)} = 1.053 \text{ mm/V}$$

2e) Feed rate controller for a linear

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$$3ii) \quad 15 \times 0.85 = 12.75$$

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$$E_{ss} = \theta_i \left(\frac{G-1}{1+GH} \right)$$

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$$= \theta_i \left(\frac{12.75 \times 0.35 - 1}{1 + (12.75 \times 0.35 \times 0.8095)} \right)$$

$$E_{ss} = -0.033 \theta_i$$

36) Time constant is RC