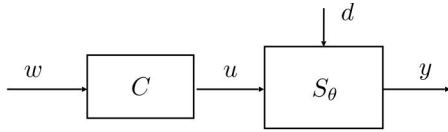


Control systems

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I. CONTROL SYSTEM



Notation:

- S_Θ : System to be controlled
- C : Controller
- Θ : System parameters
- y : Controlled variable i.e. output
- u : Control variable (accessible)
- d : Disturbance factors
- w : Reference variable i.e. point

A. Control system objective

- Act on u to maintain $y \approx w$ in the presence of uncertainty

$$d = \bar{d} + \Delta d$$

$$\Theta = \bar{\Theta} + \Delta\Theta$$

- \bar{d} and $\bar{\Theta}$ are known nominal values i.e. expected
- Δd and $\Delta\Theta$ are uncertainties

- Uncertainty Δd may have a known upper bound

$$|\Delta d| < \bar{D}$$

II. CONTROLLER

- Two kinds of controllers:
 - Analog: Receives analog inputs and outputs analog
 - Digital: Processes digital sampled variables in computing devices
- Conversion between two types requires: **ADC** and **DAC**
- Converters are synchronised via clock signal - period T_s
- Discrete-time variables can be expressed with time index

$$t_k = kT_s \Rightarrow k$$

A. Digital control systems

- **Hybrid systems** with analog and digital variables

