1 Basic feedback loop transfer functions

System outputs depend on system inputs.

Statics inputs, outputs x, y are numbers. Transfer function is $y = F(x)$.

If we deal with linear system then $y = K \cdot x$, where K - is a **gain.**

Dynamics $y(t) = Q[x(t)]$, where Q is an operator $(d/dt, \ldots)$.

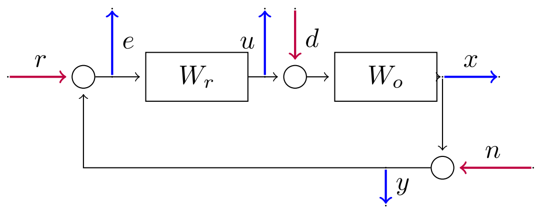

Figure 1: The pure error feedback loop

What are the closed system transfer functions?

$$\begin{matrix} d \\ r \\ n \end{matrix} \rightarrow \begin{matrix} y \\ u \\ x \\ e \end{matrix}$$

2 Approximation with FOPDT

FOPDT model: $W_m(s) = \frac{K}{1+\tau_o \cdot s} e^{-\theta s}$ where $s = j\omega$

SOPDT model: $W_m(s) = \frac{K}{(1+\tau_1 \cdot s)(1+\tau_2 \cdot s)} e^{-\theta s}$,

Simplify the next transfer functions:

1. $W_1 = \frac{13.7}{(1+120s)(1+36s)}$
2. $W_2 = \frac{K}{(1+10s)(1+36s)(1+120s)(1+14s)}$
3. $W_3 = \frac{13.7}{(1+120s)(1+36s)} e^{-18s}$
4. $W_4 = \frac{13.7(1+12s)}{(1+10s)(1+6s)} e^{-s}$
5. $W_5 = \frac{13.7(1-12s)}{(1+120s)(1+36s)} e^{-18s}$
6. $W_6 = \frac{K(1+12s)(1-4s)}{(1+120s)(1+36s)(1+14s)(1+10s)} e^{-9s}$
7. $W_7 = \frac{1+10s}{(1+12s)(1+23s)} e^{-3s}$

Use both General and Skogestad method.