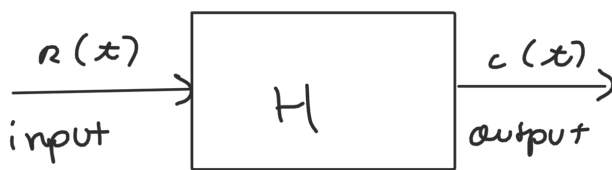


→ Control systems

Objective is to impose a given value of some physical quantity in a system by acting on some other physical quantity.

Basic concept: Systems approach input signal, output signal and process transforming input to output. The objective is to impose a given value at a system's output by acting in its input.

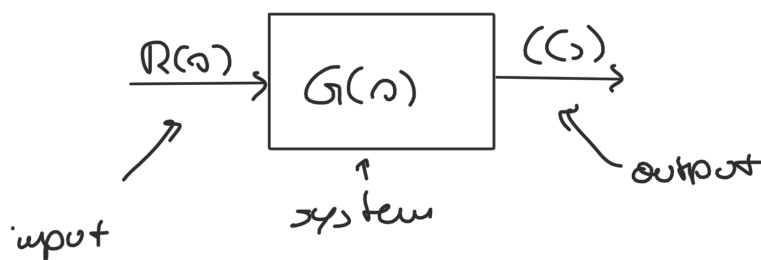


$r(t)$ and $c(t)$ are related by differential equations.

Differential equations are simplified by the use of Laplace Transforms. ($U(t)$ is the unit step function).

→ Transfer function

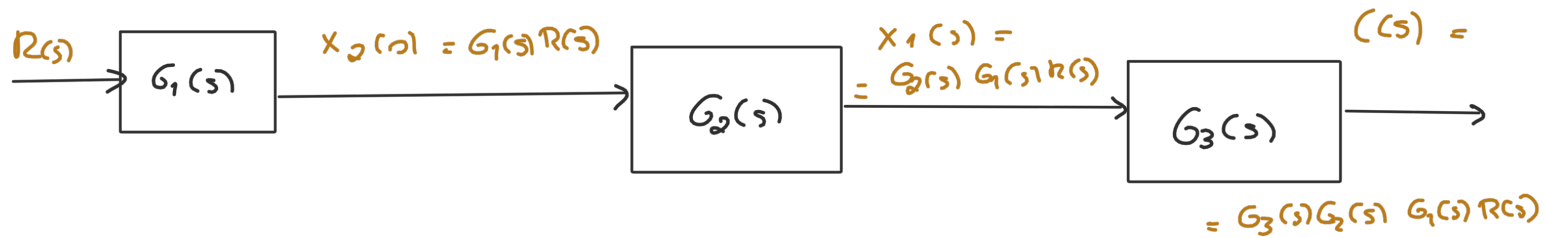
$$C(s) = G(s) \cdot R(s)$$



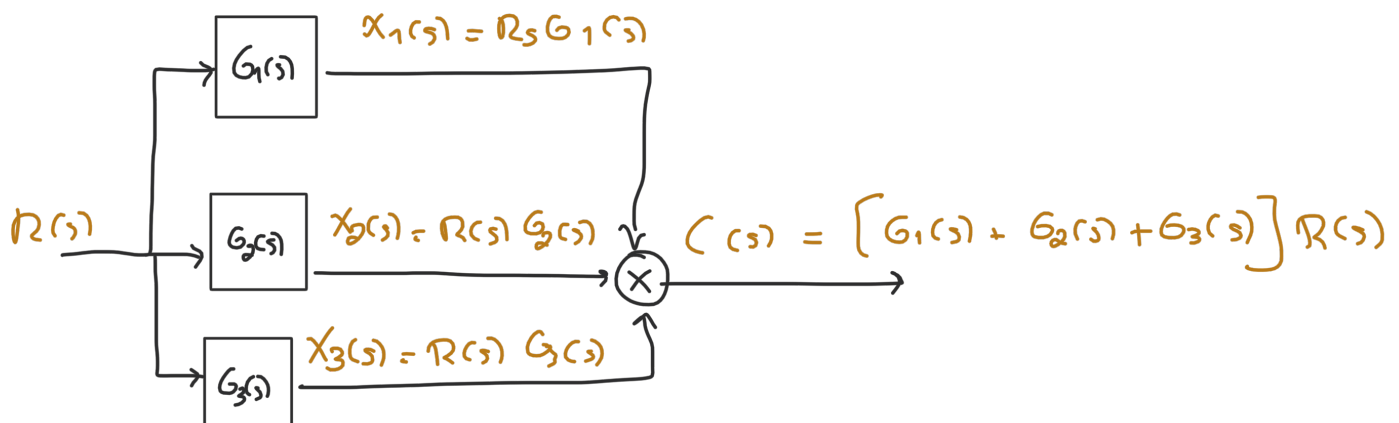
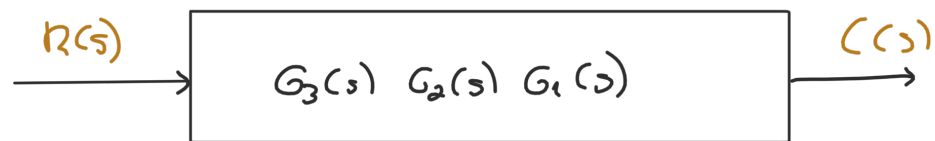
A relation expressed originally in terms of a differential equation is expressed as a product.

The physical nature of input/output relationship is irrelevant, only mathematical relationship matters - **abstraction**

→ Block diagram algebra

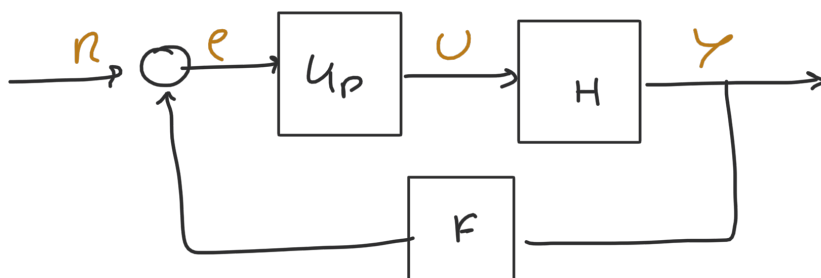


↳ multiplication
✓



↳ Controller:

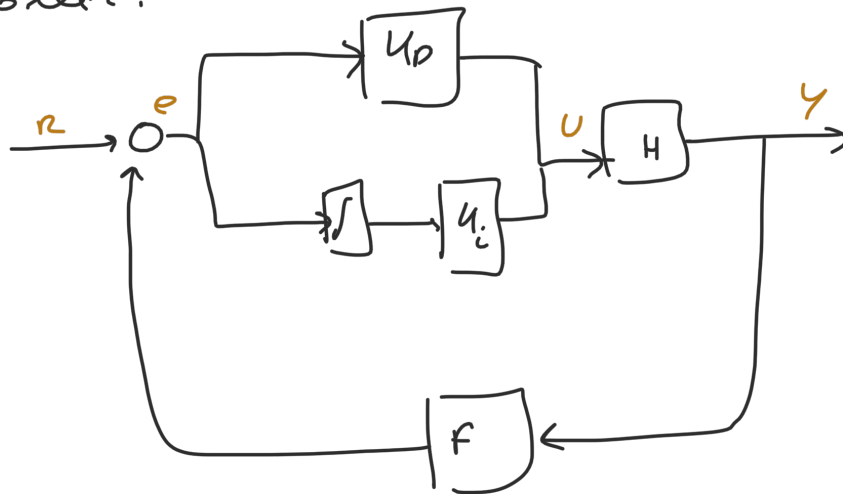
- **P**: simplest form of linear controller, uses a control feedback mechanism to control the process variable by adjusting output. (proportional)



To reduce error, high value of K_p is required.

High K_p may cause instability.

- **PI**: combination of proportional controller and integral controller. Eliminates steady state error of P controllers.



- **PID**: previous controllers plus derivative which helps to anticipate future error

