



Typical f/b Closed Loop Control system

$$a_2 \frac{dy}{dt^2} + a_1 \frac{dy}{dt} + a_0 y(t) = x(t)$$

(2nd order, Type 0)

$$\frac{d}{dt} \left[ a_2 \frac{dy}{dt} + a_1 y \right] = x(t)$$



$$CR \frac{dv_c}{dt} + v_c = v_i$$

$$\frac{dv_c}{dt} + \frac{v_c}{CR} = \frac{v_i}{CR}$$

$$v_i = i \cdot R + v_c$$

$$i = C \frac{dv_c}{dt}$$

$$\frac{1}{CR} = \tau \text{ time constant}$$

$$v_i = CR \frac{dv_c}{dt} + v_c$$

$$V_R = R \cdot i \quad \text{--- (1)}$$

$$V_L = L \frac{di}{dt} \quad \text{--- (2)}$$

$$v_c = \frac{1}{C} \int i dt \quad \text{--- (3)}$$

$$\frac{dv_c}{dt} = \frac{i}{C} \quad \text{--- (3')}$$

$$i = C \frac{dv_c}{dt} \quad \text{--- (3'')}$$

