

## Electrical Systems Examples

### 1. RLC circuit

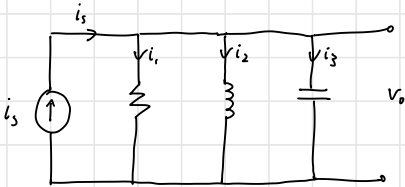


$$V_s - Ri - L \frac{di}{dt} - \frac{1}{C} \int i dt = 0$$

$$\frac{dV_s}{dt} - R \frac{di}{dt} - L \frac{d^2i}{dt^2} - \frac{1}{C} i = 0$$

$$\frac{dV_s}{dt} = R \frac{di}{dt} + L \frac{d^2i}{dt^2} + \frac{1}{C} i$$

### 2.



$$i_s = i_1 + i_2 + i_3$$

$$i_1 = \frac{V_o}{R}$$

$$i_2 = \frac{1}{L} \int V_o dt$$

$$i_3 = C \dot{V}_o$$

$$\rightarrow i_s = \frac{V_o}{R} + \frac{1}{L} \int V_o dt + C \dot{V}_o$$

$$\frac{di_s}{dt} = \frac{\dot{V}_o}{R} + \frac{1}{L} V_o + C \ddot{V}_o$$

If  $i_1$  is the output of interest:

$$V_o = i_1 R$$

$$\frac{di_s}{dt} = \frac{(i_1 R)}{R} + \frac{1}{L} (i_1 R) + C ((i_1 R))$$

$$= \frac{R}{R} \frac{di_1}{dt} + \frac{R}{L} i_1 + CR \frac{d^2 i_1}{dt^2}$$