



1. Maxwell

$$f = f_1 = f_2$$

$$\leadsto \text{Laplace } \bar{f} = \bar{f}_1 + \bar{f}_2$$

$$f = c_1 \dot{y}_1$$

$$\bar{f} = c_1 s \bar{y}_1$$

$$y = y_1 + y_2$$

$$\bar{y} = \bar{y}_1 + \bar{y}_2$$

2. Zener

$$f = f_a + f_b$$

$$\leadsto \text{Laplace } \bar{f} = \bar{f}_a + \bar{f}_b$$

$$y_2 = y_1 + y_4$$

$$\bar{y}_2 = \bar{y}_1 + \bar{y}_4$$

$$f_a = k_1 y_2$$

$$\bar{f}_a = k_1 \bar{y}_2$$

$$f_b = c_2 \dot{y}_1$$

$$\bar{f}_b = s c_2 \bar{y}_1$$

$$f_b = k_2 y_4$$

$$\bar{f}_b = k_2 \bar{y}_4$$

$$\text{I} \quad \Rightarrow \bar{y}_2 = \frac{\bar{f}_b}{c_2 s} + \frac{\bar{f}_b}{k_2} = \bar{f}_b \left( \frac{k_2 + c_2 s}{k_2 c_2 s} \right) \Rightarrow \boxed{\bar{f}_b = \bar{y}_2 \frac{k_2 c_2 s}{k_2 + c_2 s}}$$

$$\text{II} \quad \Rightarrow \bar{f} = \bar{f}_a + \bar{f}_b = \bar{y}_2 \left( k_1 + \frac{k_2 c_2 s}{k_2 + c_2 s} \right) = \bar{y}_2 \left( \frac{k_1 k_2 + (k_1 + k_2) c_2 s}{k_2 + c_2 s} \right)$$

$$\text{III} \quad \Rightarrow \bar{y} = \bar{y}_1 + \bar{y}_2 = \left( \frac{1}{c_1 s} + \frac{k_2 + c_2 s}{k_1 k_2 + (k_1 + k_2) c_2 s} \right) \bar{f}$$

$$\bar{y} = \frac{k_1 k_2 + (k_1 + k_2) c_2 s + k_2 c_1 s + c_1 c_2 s^2}{k_1 k_2 c_1 s + (k_1 + k_2) c_1 c_2 s^2} \bar{f}$$

$$\Rightarrow (k_1 + k_2) c_1 c_2 s^2 \bar{y} + k_1 k_2 c_1 s \bar{y} = c_1 c_2 s^2 \bar{f} + \underbrace{[(k_1 + k_2) c_2 + k_2 c_1]}_{c_1} s \bar{f} + \underbrace{k_1 k_2}_{c_1} \bar{f}$$

$$\Rightarrow s^2 \bar{y} + \frac{1}{\tilde{c}} s \bar{y} = \frac{1}{k_1 + k_2} s^2 \bar{f} + \left[ \frac{1}{c_1} + \frac{k_2}{(k_1 + k_2) c_2} \right] s \bar{f} + \frac{1}{2 c_1} \bar{f}$$

↪ Laplace

$$\ddot{y} + \frac{1}{\tilde{c}} \dot{y} = \frac{1}{k_1 + k_2} \ddot{f} + \left[ \frac{1}{c_1} + \frac{1}{\tilde{c} k_1} \right] \dot{f} + \frac{1}{\tilde{c} c_1} f$$

$$\boxed{\tilde{c} = \frac{c_2 (k_1 + k_2)}{k_1 k_2}}$$