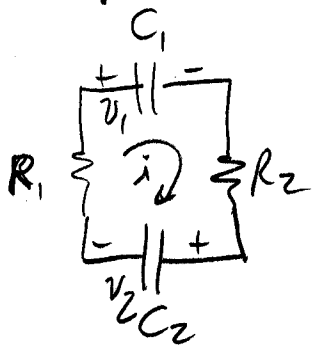
Multiple C's, L's



Series C's

KVL

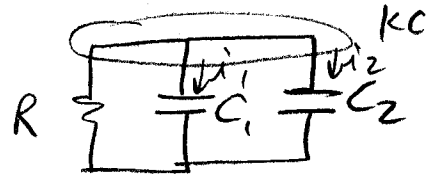
$$R_1 i + \frac{1}{C_1}\int i\,dt + R_2 i + \frac{1}{C_2}\int i\,dt = 0$$

$$(R_1+R_2)i + \left(\frac{1}{C_1}+\frac{1}{C_2}\right)\int i\,dt = 0$$

$$(R_1+R_2)\frac{di}{dt} + \left(\frac{1}{C_1}+\frac{1}{C_2}\right) i = 0$$

$$\frac{di}{dt} = \frac{1}{(R_1+R_2)}\cdot\left(\frac{1}{C_1}+\frac{1}{C_2}\right) i$$

$$\frac{di}{dt} = \frac{1}{R_{eq}C_{eq}}\, i \rightarrow \boxed{R_{eq} = R_1+R_2 \quad \frac{1}{C_{eq}} = \frac{1}{C_1}+\frac{1}{C_2}}$$



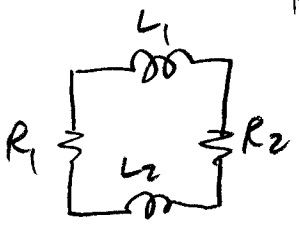
Parallel C's

KCL

$$\frac{v}{R} + C_1\frac{dv}{dt} + C_2\frac{dv}{dt} = 0$$

$$(C_1+C_2)\frac{dv}{dt} = -\frac{v}{R}$$

$$\frac{dv}{dt} = \frac{-1}{R(C_1+C_2)}\, v, \quad \boxed{R_{eq} = R \quad C_{eq} = C_1+C_2}$$



Series L's

KVL

$$R_1 i + L_1\frac{di}{dt} + R_2 i + L_2\frac{di}{dt} = 0$$

$$(L_1+L_2)\frac{di}{dt} = -(R_1+R_2)i$$

$$\frac{di}{dt} = -\frac{(R_1+R_2)}{(L_1+L_2)}\, i, \quad \boxed{R_{eq} = R_1+R_2 \quad L_{eq} = L_1+L_2}$$

Parallel L's. $\frac{v}{R} + \frac{1}{L_1}\int v\,dt + \frac{1}{L_2}\int v\,dt = 0$

KCL

$$\frac{1}{R}\frac{dv}{dt} + \frac{v}{L_1} + \frac{v}{L_2} = 0, \quad \frac{dv}{dt} = -R\left(\frac{1}{L_1}+\frac{1}{L_2}\right) v$$

$$\boxed{\frac{1}{L_{eq}} = \frac{1}{L_1}+\frac{1}{L_2}}$$