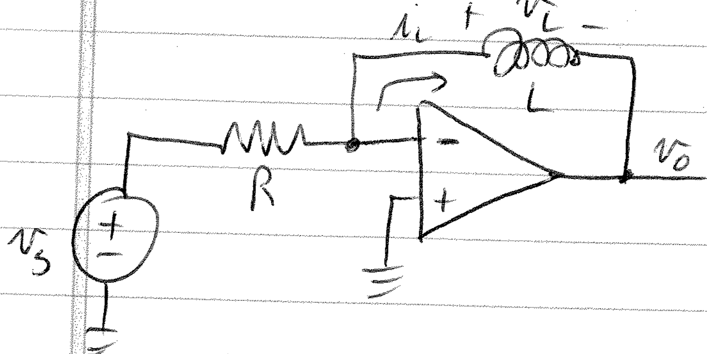
"Duality" - Interchange i + v in all statements and change L + C, and ~~ever~~ R for $\frac{1}{R}$, and everything remains correct.

List on pg 292 →

KVL →	KCL
Loop →	Node
R	Conductance
V src	I src
Thev.	Norton
S.C.	O.C.
Series	Parallel
C	L

$$i_C = C\frac{dv_C}{dt} \longleftrightarrow v_L = L\frac{di_L}{dt}$$

C's + L's with Op-Amps



$v_P = v_N = 0$

$$\frac{\overset{0}{\cancel{v_N}} - v_s}{R} + i_L = 0$$

$$-\frac{1}{R}v_s + i_L(0) + \frac{1}{L}\int_0^t v_L(x)\,dx = 0$$

$$\text{Take } \frac{d}{dt}: \ -\frac{1}{R}\frac{dv_s}{dt} + 0 + \frac{1}{L}v_L(t) = 0$$

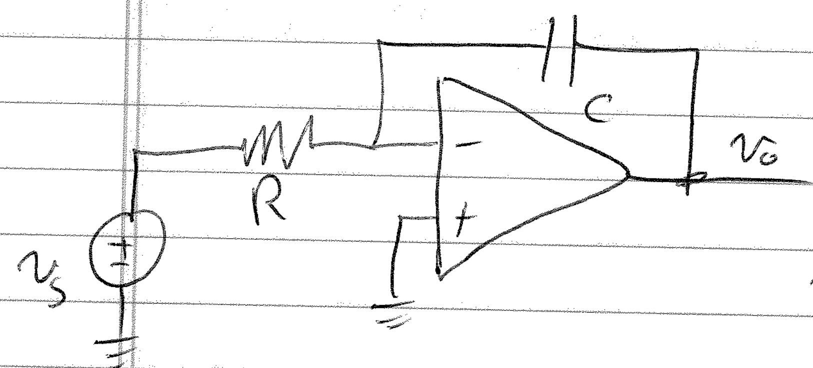
But $v_L = v_N - v_o = 0 - v_o(t) = -v_o(t)$

so $$-\frac{1}{R}\frac{dv_s}{dt} + \frac{1}{L}(-v_o) = 0$$

$$v_o = -\frac{L}{R}\frac{dv_s}{dt}$$

inverting differentiator using L.

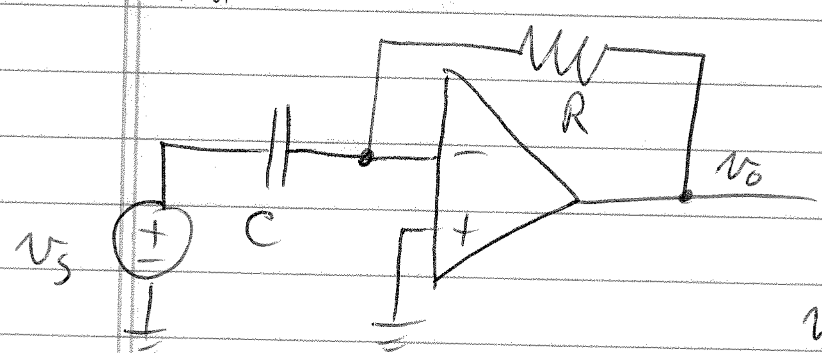
Examples in text are using C's instead of L's:



Inverting Integrator:

$$v_o = v_o(0) - \frac{1}{RC}\int_0^t v_s(x)\,dx$$

and



Inverting Differentiator:

$$v_o = -RC\frac{dv_s(t)}{dt}$$

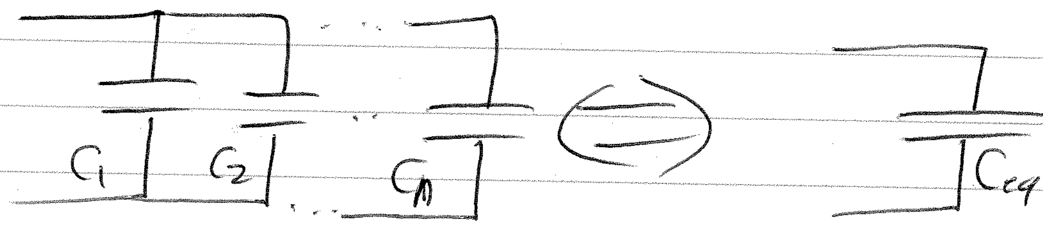
Usually we use C's rather than L's because

C's are 1) cheaper, 2) lighter, 3) smaller, 4) more "contained" than L's.

Read + Do examples + Exercises 6-9 + 6-10.

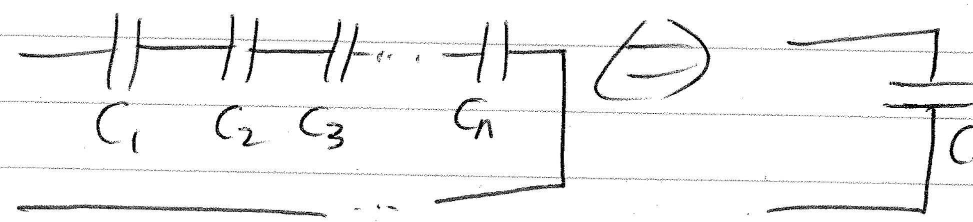
L + C combinations: (I'm not going to do the derivations, you can read them.)

C's



$$C_{eq} = \sum_{i=1}^{n} C_i$$

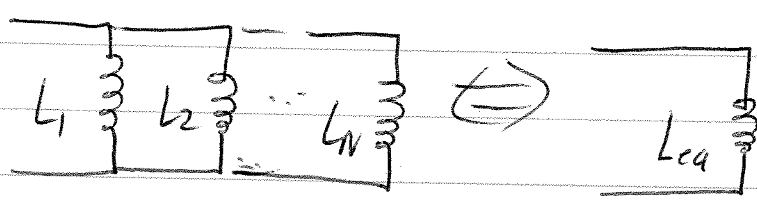
Capacitors in parallel add



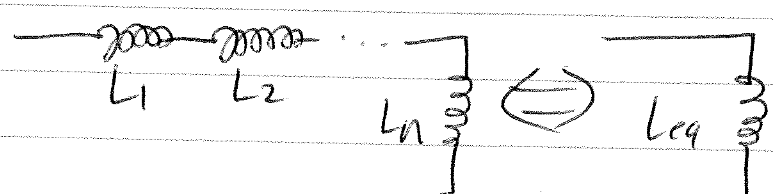
$$C_{eq} = \frac{1}{\sum_{i=1}^{n} \frac{1}{C_i}}$$

C's in series combine as $\frac{1}{\sum \frac{1}{C}}$

L's



$$L_{eq} = \frac{1}{\sum_{i=1}^{n} \frac{1}{L_i}}$$



$$L_{eq} = \sum_{i=1}^{n} L_i$$