• 电容：一个电容包括两个导电板，中间由电介质隔开　利用电场储存能量

$q = Cv$　C为电容常数，单位法拉(F)　$1F = 1C/V$　电路中看作断路

$C = \frac{\varepsilon A}{d}$　ε为介电质的介电常数.

$v_i > 0$ 电容充电　$v_i < 0$ 电充放电

• $i = C\frac{dv}{dt}$

$v(t) = \frac{1}{C}\int_{-\infty}^{t} i(\tau)\,d\tau + v(t_0)$.　$v(t_0) = \frac{q(t_0)}{C}$ 是 t_0 时刻作用在电容上的电压值

$p = vi = Cv\frac{dv}{dt}$ 瞬时功率

$w = \int_{-\infty}^{t} p(\tau)\,d\tau = C\int_{-\infty}^{t} v\frac{dv}{d\tau}\,d\tau = C\int_{v(-\infty)}^{v(t)} v\,dv = \frac{1}{2}Cv^2\Big|_{v(-\infty)}^{v(t)}$

$t=-\infty$ 时，$v(-\infty)=0$　$\therefore w = \frac{1}{2}Cv^2 = \frac{q^2}{2C}$

• N个并联电容的等效电容是各个电容的和.
N个串联电容的等效电容是各个电容的倒数和的倒数.

• 电感：电感由导线绕成的线圈组成　利用磁场储存能量

• $v = L\frac{di}{dt}$　L 感应系数，单位 亨利 H　电路中看作短路

$L = \frac{N^2\mu A}{l}$　μ 磁芯的磁导率

• $di = \frac{1}{L}v\,dt$

$i = \frac{1}{L}\int_{-\infty}^{t} v(\tau)\,d\tau = \frac{1}{L}\int_{-\infty}^{t} v(\tau)\,d\tau + i(t_0)$

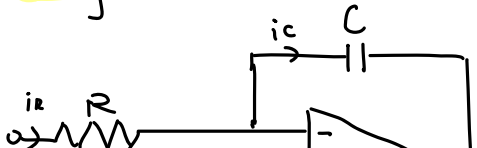
$p = vi = (L\frac{di}{dt})i$

$w = L\int_{-\infty}^{t}\frac{di}{d\tau}i\,d\tau = L\int_{-\infty}^{t} i\,di = \frac{1}{2}Li^2(t) - \frac{1}{2}Li^2(-\infty) = \frac{1}{2}Li^2$

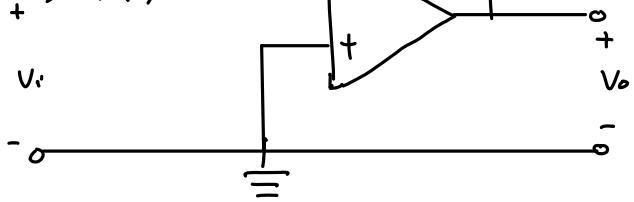
• N个并联电感的等效电感系数是各电感的倒数和的倒数
N个串联电感的等效电感系数是各电感的感应系数之和.

应用：

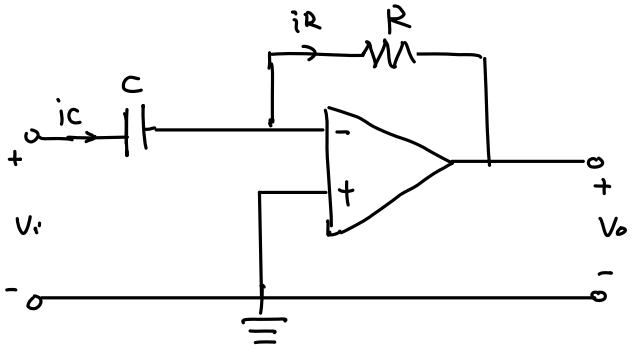
integrator 积分器



$V_o = -\frac{1}{RC}\int_0^t V_i\,dt + V_o(0)$



differentiator 微分器



$$V_o = -RC\frac{dV_i}{dt}$$

- 加法放大器 Summing amplifier

将多个输入合并，在输出端产生这些输入加权和的运放。

$$V_o = -\left(\frac{Rf}{R_1}V_1 + \frac{Rf}{R_2}V_2 + \frac{Rf}{R_3}V_3\right)$$