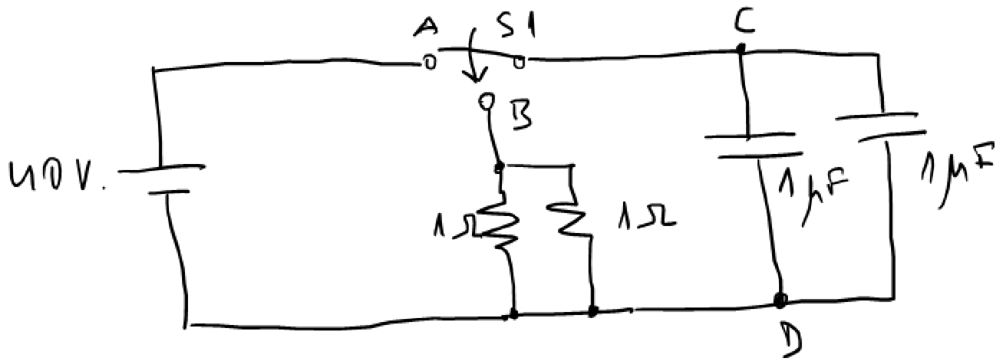
1. (5 points) The switch S1 in the following circuit has been in position A for a long time. Assume the switch S1 moves instantaneously from position A to position B at t = 0 s. (a) Find the equivalent resistance to the two 1 Ω parallel resistances. (b) Find the equivalent capacitance to the two parallel 1 μF capacitances. (c) Find the time constant of the circuit (τ), (d) Find the initial voltage $v_{CD}(0)$, and (e) Find $v_{CD}(t)$ for t > 0.

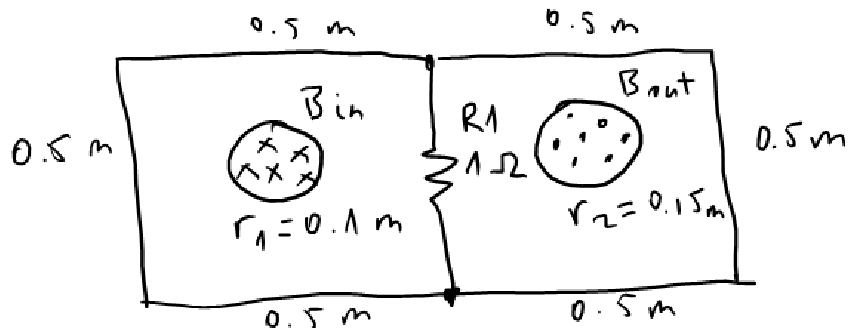


(a) $R_{eq} = \frac{R_1 \cdot R_2}{R_1 + R_2} = \frac{1}{2}\,\Omega$ (b) $C_{eq} = C_1 + C_2 = 2\,\mu F$

(c) $\tau = \frac{1}{2}\,\Omega \cdot 2\,\mu F = 10^{-6}\,s$ (d) $v_{CD}(0) = 40\,V.$

(e) $v_{CD}(t) = 40 \cdot e^{-\frac{t}{10^{-6}}}\,V.$

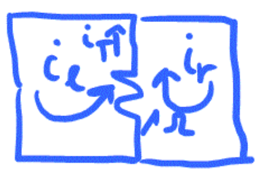
2. (5 points) Two circular magnetic fields (B_{in} and B_{out}) of respective radius r_1 = 0.1 m and r_2 = 0.15 m, pass perpendicular to the loops as shown in figure. The magnitudes are the same (B_{in}=B_{out}) and are increasing at a rate of 100 T/s. (a) Find the emf induced in the loop of the right, (b) Find the emf induced in the loop in the loop of the left. (c) Find the direction of the current through R1, and (d) Find the magnitude of the current through R1.



(a) $\mathcal{E}_r = A\frac{dB}{dt} = \pi(0.15m)^2 \cdot (100\,T/s) = 2.25\pi\ V$

(b) $\mathcal{E}_\ell = A\cdot\frac{dB}{dt} = \pi(0.1m)^2\cdot(100\,T/s) = \pi\ V$

(c)



(d) $i_T = i_\ell + i_r =$

$= \frac{\pi V}{1\Omega} + \frac{2.25\pi V}{1\Omega} =$

$= 3.35\pi\ A$

[In the presence of a changing magnetic field E is no conservative]