Capacitor

`Q = CV`

Unit = Farad

C of spherical conductor `C = 4 pi epsilon\_{0}R`

Energy stored in a capacitor `U = 1/2CV^2`

Redistribution of charge when to spherical conductions of capacitance `C\_{1}` and `C\_{2}` are joined

`(q\_{1}’)/(q\_{2}’)= C\_{1}/C\_{2} = R\_{1}/R\_{2}`

Common potential(V) = `(text(total charge))/(text(total capacity)) = (q\_{1} + q\_{2})/(C\_{1} + C\_{2})`

Loss of energy due to redistribution

`U\_{i} = 1/2(q\_{1}^2)/(C\_{1}) + 1/2q\_{2}^2/C\_{2}`

`U\_{f} = 1/2((q\_{1} + q\_{2})^2)/(C\_{1} + C\_{2})`

`delta U = (C\_{1}C\_{2})/(2(C\_{1} + C\_{2}))(v\_{1} – v\_{2})^2`

`E = sigma/eplison\_{0}` in between plate

`C = (eplison\_{0}A)/d` capacitance depend only on A and d

For n plate `C = ((n – 1)epsilon\_{0}A)/d`

For dielectrics

`E = E\_{0}/k text( ) v = v\_{0}/k`

&image&

E0

-σ

σ

Ei

`E = E\_{0} – E\_{i}`

`E\_{0}/k = E\_{0} – E\_{i}`

`sigma\_{i} = sigma(1 – 1/k)`

`q\_{i} = q(1 – 1/k)`

`E\_{vacum} = E\_{0} = q/(Aepsilon\_{0}) = sigma /epsilon\_{0}`

`E\_{diel} = E\_{0}/k`

`C = kC\_{0}`

`E\_{conductor} = 0`

Partial dielectric

`C = (epsilon\_{0}A)/(d-t + t/k)`

Case 1: More than 1

`C = (epsilon\_{0}A)/(d – t\_{1} – t\_{2}…..t\_{n}) + (t\_{1}/k\_{1} + t\_{2}/k\_{2}…..t\_{n}/k\_{n})`

Case 2: t = d

`C = (kepsilon\_{0}A)/d`

Case 3: conductor, `k = infty`

`C = (epsilonA)/(d – t)`

Case 4: t = d and k = `infty`

`C = infty`

Capacitance of cylinder capacitor

C per unit length = `(2piepsilon\_{0})/ln(b/a)`

Force on charged conductor

`F/A = 1/2epsilon\_{0}E^2`

Force of plate attraction

`F = q^2/(2Aepsilon\_{0})`

Series capacitor

`1/C\_{s} = 1/C\_{1} +1/C\_{2}`

`V\_{1}/V\_{2} = C\_{2}/C\_{1}`

Parallel capacitor

`C\_{p} = C\_{1} +C\_{2}`

`q\_{1}/q\_{2} = C\_{1}/C\_{2}`

energy density

`U = 1/2epsilon\_{0}kE^2`

C-R circuits

`q = q\_{0}(1 – e^(-t/tau\_{L}))`

`tau\_{L} = CR` = time constant

`I = i\_{0}e^(-t/tau\_{L})`

&image&

x

R2

R1

`X = (R\_{1} plusminus sqrt(R\_{1}^2 4R\_{1}R\_{2}))/2`

&image&

R2

R1

x

R3

`X = (R\_{s} plusminus sqrt(R\_{s}^2 + 4R\_{s}R\_{2}))/2`