EC1311: FORMULARIO Nº 4

TEOREMA DE POYNTING

1.- Caso general.

$$P_S = \oint\!\!\!\oint_{S=\delta V} S \cdot da + P_D + P_P + P_M + \frac{dU_E}{dt} + \frac{dU_H}{dt}$$

$$P_S = -\iiint_{V \cap V_J} E \cdot J_S \, dV - \iint_{V \cap S_K} E \cdot K_S \, da - \int_{V \cap L_I} E \cdot I_S \, dl$$

$$P_D = \iiint_{V \cap V_J} E \cdot J_C \, dV + \iint_{V \cap S_K} E \cdot K_C \, da + \int_{V \cap L_I} E \cdot I_C \, dl$$

$$P_P = \iiint_{V \cap V_P} E \cdot \frac{\partial P}{\partial t} dV, \quad P_M = \iiint_{V \cap V_M} H \cdot \frac{\partial(\mu_0 M)}{\partial t} dV,$$

$$U_E = \iiint_V \frac{\varepsilon_0}{2} |E|^2 \, dV, \quad U_H = \iiint_V \frac{\mu_0}{2} |H|^2 \, dV$$

$$p_S = \nabla \cdot S + p_D + p_P + p_M + \frac{\partial u_E}{\partial t} + \frac{\partial u_H}{\partial t}$$

$$p_S = -E \cdot J_S, \qquad p_D = E \cdot J_C, \qquad p_P = E \cdot \frac{\partial P}{\partial t},$$

$$p_M = H \cdot \frac{\partial(\mu_0 M)}{\partial t}, \quad u_E = \frac{\varepsilon_0}{2}|E|^2, \quad u_H = \frac{\mu_0}{2}|H|^2$$

$$1n \cdot [S|_{S^+} - S|_{S^-}] = -E \cdot K_S - E \cdot K_C$$

2.- Materiales lineales e isotrópicos.

$$P_S = \oint\!\!\!\oint_{S=\delta V} S \cdot da + P_D + \frac{dU_e}{dt} + \frac{dU_m}{dt}$$

$$P_D = \iiint_{V \cap V_\sigma} \sigma |E|^2 \, dV + \iint_{V \cap S_{\sigma_s}} \sigma_s |E|^2 \, da$$

$$U_e = \iiint_V \frac{\varepsilon}{2} |E|^2 \, dV, \quad U_m = \iiint_V \frac{\mu}{2} |H|^2 \, dV$$

$$U_e = \frac{1}{2} C V^2, \quad U_m = \frac{1}{2} L I^2, \quad P_D = R I^2 = V^2 / R$$

$$p_S = \nabla \cdot S + p_D + \frac{\partial u_e}{\partial t} + \frac{\partial u_m}{\partial t}$$

$$p_S = -E \cdot J_S, \quad p_D = \sigma |E|^2, \quad u_e = \frac{\varepsilon}{2}|E|^2, \quad u_m = \frac{\mu}{2}|H|^2$$

$$1n \cdot [S|_{S^+} - S|_{S^-}] = -E \cdot K_S - \sigma_s |E|^2$$

SERIES DE FOURIER

Serie de senos:

$$f(t) \cong \sum_{n=1}^{\infty} b_n \, \mathrm{sen}(2n\pi t / T)$$

$$b_n = \frac{4}{T} \int_{T/2} f(t) \, \mathrm{sen}(2n\pi t / T) \, dt$$

SERIES DE FOURIER (cont.)

Serie de cosenos:

$$f(t) \cong \sum_{n=0}^{\infty} a_n \cos(2n\pi t / T)$$

$$a_n = \frac{4}{T} \int_{T/2} f(t) \cos(2n\pi t / T) \, dt$$

ELECTROSTATICA

$$E = -\nabla \phi$$

Si $\rho_V = 0$ y ε=constante: $\nabla^2 \phi = 0$

Condiciones de frontera:

Conductor ideal: ϕ=constante

Fuente de voltaje: $\phi = V(r)$

Carga superficial:

$$-\left[\varepsilon \frac{\partial \phi}{\partial n}\right]_{S^+} + \left[\varepsilon \frac{\partial \phi}{\partial n}\right]_{S^-} = \eta(S)$$

Interfaz conductor-aislante:

$$\left[\frac{\partial \phi}{\partial n}\right]_{\text{conductor}} = 0$$

Interfaz aislante-aislante:

$$\left[\varepsilon \frac{\partial \phi}{\partial n}\right]_{S^+} = \left[\varepsilon \frac{\partial \phi}{\partial n}\right]_{S^-}$$

Interfaz conductor-conductor:

$$\left[\sigma \frac{\partial \phi}{\partial n}\right]_{S^+} = \left[\sigma \frac{\partial \phi}{\partial n}\right]_{S^-}$$

Cualquier Interfaz:

$$[\phi]_{S^+} = [\phi]_{S^-}$$

MAGNETOSTATICA

Si $J + \sigma E = 0$ y μ=constante:
$H = -\nabla \phi_m$, $\nabla^2 \phi_m = 0$

Condiciones de frontera:

$$1n \cdot [(\mu H)|_{S^+} - (\mu H)|_{S^-}] = 0$$

$$1n \times [H|_{S^+} - H|_{S^-}] = K + \sigma_s E$$