Electrodinámica:

($\hat{\mathbf{n}}$ tiene dirección $1 \to 2$. En los conductores, se asume que el conductor es el medio 1)

Material	**Coeficientes del medio**	**Condición de Contorno**
Dieléctricos sin pérdidas ϵ , μ reales	$\epsilon = D/E$ $n = ck/\omega = \sqrt{\mu\epsilon}$ $\eta = E/H = \sqrt{\mu/\epsilon}$	$(\mathbf{E}_2 - \mathbf{E}_1) \times \hat{\mathbf{n}} = 0$ (útil; ver abajo) $(\mathbf{D}_2 - \mathbf{D}_1) \cdot \hat{\mathbf{n}} = 0$ $(\mathbf{B}_1 - \mathbf{B}_2) \cdot \hat{\mathbf{n}} = 0$ $(\mathbf{H}_1 - \mathbf{H}_2) \times \hat{\mathbf{n}} = 0$ (útil; ver abajo)
Dieléctricos con pérdidas μ real	$\epsilon = D/E = \epsilon_r + i\,\epsilon_i$ $n = ck/\omega = \sqrt{\mu\epsilon_r}\,(1 + i\,\epsilon_i/\epsilon_r)^{1/2}$ $\eta = E/H = \sqrt{\mu/\epsilon_r}\,(1 + i\,\epsilon_i/\epsilon_r)^{-1/2}$	$(\mathbf{E}_2 - \mathbf{E}_1) \times \hat{\mathbf{n}} = 0$ (útil; ver abajo) $(\mathbf{D}_2 - \mathbf{D}_1) \cdot \hat{\mathbf{n}} = 0$ $(\mathbf{B}_1 - \mathbf{B}_2) \cdot \hat{\mathbf{n}} = 0$ $(\mathbf{H}_1 - \mathbf{H}_2) \times \hat{\mathbf{n}} = 0$ (útil; ver abajo)
Conductores perfectos	$\mathbf{E}_c = 0$	$\mathbf{E}_2 \times \hat{\mathbf{n}} = 0$ (útil; ver abajo) $\mathbf{H}_2 \times \hat{\mathbf{n}} = -(4\pi/c)\,\mathbf{g}_L$
Conductores reales ϵ , μ real	$\sigma = J/E$ $n = ck/\omega = \sqrt{\mu\epsilon}\,[1 + i\,4\pi\sigma/(\omega\epsilon)]^{1/2}$ $\eta = E/H = \sqrt{\mu/\epsilon}\,[1 + i\,4\pi\sigma/(\omega\epsilon)]^{-1/2}$	$(\mathbf{E}_2 - \mathbf{E}_1) \times \hat{\mathbf{n}} = 0$ (útil; ver abajo) $(\mathbf{D}_2 - \mathbf{D}_1) \cdot \hat{\mathbf{n}} = 0$ $(\mathbf{B}_1 - \mathbf{B}_2) \cdot \hat{\mathbf{n}} = 0$ $(\mathbf{H}_c - \mathbf{H}_2) \times \hat{\mathbf{n}} = 0$ (útil; ver abajo)
Plasma diluido ϵ , μ real	$\sigma(\omega) = J/E = i\,\omega_p^2/(4\pi\omega)$ $n = ck/\omega = \sqrt{\mu\epsilon}\,[1 - \omega_p^2/(\epsilon\,\omega^2)]^{1/2}$ $\eta = E/H = \sqrt{\mu/\epsilon}\,[1 - \omega_p^2/(\epsilon\,\omega^2)]^{-1/2}$	$(\mathbf{E}_2 - \mathbf{E}_1) \times \hat{\mathbf{n}} = 0$ (útil; ver abajo) $(\mathbf{D}_2 - \mathbf{D}_1) \cdot \hat{\mathbf{n}} = 0$ $(\mathbf{B}_1 - \mathbf{B}_2) \cdot \hat{\mathbf{n}} = 0$ $(\mathbf{H}_c - \mathbf{H}_2) \times \hat{\mathbf{n}} = 0$ (útil; ver abajo)

Incidencia sobre una capa material:

1 =medio incidente, 2 =capa material y 3 =medio transmitido. Contorno 1-2 en $z = 0$ y contorno 2-3 en $z = -d$

textbfnota: en el caso de un conductor perfecto: $E_c = 0$ y $H_c = 0$. No usar las siguientes relaciones!

Modo	**Condiciones de contorno**	**Ángulos e impedancias**
T.E. $(z = 0)$	$E_i^{(1)} + E_r^{(1)} = E_i^{(2)} + E_r^{(2)}$ $E_i^{(1)} \cos\theta_1/\eta_1 - E_r^{(1)} \cos\theta_1/\eta_1 = E_i^{(2)} \cos\theta_2/\eta_2 - E_r^{(2)} \cos\theta_2/\eta_2$	$n_1 \operatorname{sen}\theta_1 = n_2 \operatorname{sen}\theta_2$
T.E. $(z = -d)$	$E_t^{(2)}\, e^{ik_2 d\cos\theta_2} + E_r^{(2)}\, e^{-ik_2 d\cos\theta_2} = E_t^{(2)}\, e^{ik_3 d\cos\theta_3}$ $E_t^{(2)}\, e^{ik_2 d\cos\theta_2} \cos\theta_2/\eta_2 - E_r^{(2)}\, e^{-ik_2 d\cos\theta_2} \cos\theta_2/\eta_2 = E_t^{(3)}\, e^{ik_3 d\cos\theta_3} \cos\theta_3/\eta_3$	$n_2 \operatorname{sen}\theta_2 = n_3 \operatorname{sen}\theta_3$
T.M. $(z = 0)$	$E_i^{(1)} \cos\theta_1 - E_r^{(1)} \cos\theta_1 = E_i^{(2)} \cos\theta_2 - E_r^{(2)} \cos\theta_2$ $E_i^{(1)}/\eta_1 + E_r^{(1)}/\eta_1 = E_i^{(2)}/\eta_2 + E_r^{(2)}/\eta_2$	$n_1 \operatorname{sen}\theta_1 = n_2 \operatorname{sen}\theta_2$
T.M. $(z = -d)$	$E_t^{(2)}\, e^{ik_2 d\cos\theta_2} \cos\theta_2 - E_r^{(2)}\, e^{-ik_2 d\cos\theta_2} \cos\theta_2 = E_t^{(2)}\, e^{ik_3 d\cos\theta_3} \cos\theta_3$ $E_t^{(2)}\, e^{ik_2 d\cos\theta_2}/\eta_2 + E_r^{(2)}\, e^{-ik_2 d\cos\theta_2}/\eta_2 = E_t^{(3)}\, e^{ik_3 d\cos\theta_3}/\eta_3$	$n_2 \operatorname{sen}\theta_2 = n_3 \operatorname{sen}\theta_3$

$$\begin{cases} \tilde{n}_1 = n_1 \, \cos\theta_1 & \tilde{n}_2 = n_2 \, \cos\theta_2 & \tilde{n}_3 = n_3 \, \cos\theta_3 \\ \tilde{\eta}_1 = \eta_1/\cos\theta_1 & \tilde{\eta}_2 = \eta_2/\cos\theta_2 & \tilde{\eta}_3 = \eta_3/\cos\theta_3 \\ \tilde{k}_1 = \tilde{n}_1\omega/c & \tilde{k}_2 = \tilde{n}_2\omega/c & \tilde{k}_3 = \tilde{n}_3\omega/c \end{cases} \tag{1}$$

Modo T.E.:

$$\rho = \frac{E_r^{(1)}}{E_i^{(1)}} = \frac{\left(1 - \frac{\tilde{\eta}_1}{\tilde{\eta}_3}\right)\cos(\tilde{k}_2 d) + i\left(\frac{\tilde{\eta}_1}{\tilde{\eta}_2} - \frac{\tilde{\eta}_2}{\tilde{\eta}_3}\right)\mathrm{sen}\,(\tilde{k}_2 d)}{\left(1 + \frac{\tilde{\eta}_1}{\tilde{\eta}_3}\right)\cos(\tilde{k}_2 d) - i\left(\frac{\tilde{\eta}_1}{\tilde{\eta}_2} + \frac{\tilde{\eta}_2}{\tilde{\eta}_3}\right)\mathrm{sen}\,(\tilde{k}_2 d)} \tag{2}$$

$$\tau' = \frac{E_t^{(3)}(z=0)}{E_i^{(1)}(z=0)} = \frac{2\, e^{-i\tilde{k}_3 d}}{\left(1 + \frac{\tilde{\eta}_1}{\tilde{\eta}_3}\right)\cos(\tilde{k}_2 d) - i\left(\frac{\tilde{\eta}_1}{\tilde{\eta}_2} + \frac{\tilde{\eta}_2}{\tilde{\eta}_3}\right)\mathrm{sen}\,(\tilde{k}_2 d)} \tag{3}$$

$$\tau = \frac{E_t^{(3)}(z=-d)}{E_i^{(1)}(z=0)} = \frac{2}{\left(1 + \frac{\tilde{\eta}_1}{\tilde{\eta}_3}\right)\cos(\tilde{k}_2 d) - i\left(\frac{\tilde{\eta}_1}{\tilde{\eta}_2} + \frac{\tilde{\eta}_2}{\tilde{\eta}_3}\right)\mathrm{sen}\,(\tilde{k}_2 d)} \tag{4}$$