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$$\begin{bmatrix} P_x \\ P_y \end{bmatrix} \overset{?}{=} 6\varepsilon_0 \begin{bmatrix} \chi_{1111} B_x F_x + \chi_{1221} B_y F_y & \chi_{1122}(B_x F_y + B_y F_x) \\ \chi_{1122}(B_y F_x + B_x F_y) & \chi_{1111} B_y F_y + \chi_{1221} B_x F_x \end{bmatrix} \begin{bmatrix} S_x^* \\ S_y^* \end{bmatrix}$$

** $P = \varepsilon_0 6 \chi_{1122} (\vec{E}\cdot\vec{E}^*)\vec{E} + 3\varepsilon_0 \chi_{1221} (\vec{E}\cdot\vec{E})\vec{E}^*$

$\vec{E} = \vec{F} + \vec{B} + \vec{S} \rightarrow$ Signal

$\vec{B} \rightarrow$ Backward

$\vec{F} \rightarrow$ Forward

از طرفی پلاریزاسیون تولیدی در فرکانس ω از الگوی زیر تبعیت می‌کند.

$$P(\omega, \omega+\omega-\omega) \propto E_1(\omega)E_2(\omega)E_3(-\omega) \propto E_1(\omega)E_2(\omega)E_3^*(\omega)$$

که E_1 میدان سیگنال Forward، E_2 میدان سیگنال Backward و E_3 میدان موج Signal است. بنابراین از الگوی (**) تنها جملاتی باقی می‌مانند که حاصلضرب مولفه‌های از F، B و S^* باشند

$$(\vec{E}\cdot\vec{E}^*)E = \{E_xE_x^* + E_yE_y^*\}\{E_x\hat{i} + E_y\hat{j}\}$$

$$\rightarrow 6\chi_{1122}\varepsilon(\vec{E}\cdot\vec{E}^*)\vec{E} = 6\varepsilon_0\chi_{1122}\{E_xE_x^*E_x\hat{i} + E_xE_x^*E_y\hat{j} + E_yE_y^*E_x\hat{i} + E_yE_y^*E_y\hat{j}\}$$

$$3\varepsilon\chi_{1221}(\vec{E}\cdot\vec{E})\vec{E}^* = \{E_x^2E_x^*\hat{i} + E_x^2E_y^*\hat{j} + E_y^2E_x^*\hat{i} + E_y^2E_y^*\hat{j}\}3\varepsilon\chi_{1221}$$

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$$\rightarrow P_x = 3\varepsilon_0 \chi_{1221} \{ \underbrace{E_x^2 E_x^*}_{1} + \underbrace{E_y^2 E_x^*}_{2} \} + 6\varepsilon_0 \chi_{1122} \{ \underbrace{E_x E_x^* E_x}_{3} + \underbrace{E_y E_y^* E_x}_{4} \}$$

1. $E_x^2 E_x^* = (F_x + B_x + S_x)(F_x + B_x + S_x)(F_x^* + S_x^* + B_x^*) \Rightarrow$

$$(F_x B_x S_x^* + B_x F_x S_x^*)\, 3\varepsilon_0 \chi_{1221}$$

تنها جملاتی باشند که حاصلضرب مولفه‌های F، B و S^* باشند

2. $E_y^2 E_x^* = (F_y + B_y + S_y)(F_y + B_y + S_y)(F_x^* + B_x^* + S_x^*) \rightarrow$

$$(F_y B_y S_x^* + B_y F_y S_x^*)\, 3\varepsilon_0 \chi_{1221}$$

3. $E_x E_x^* E_x = (F_x + B_x + S_x)(F_x^* + B_x^* + S_x^*)(F_x + B_x + S_x) \rightarrow$

$$6\varepsilon_0 \chi_{1122} (F_x B_x S_x^* + B_x F_x S_x^*)$$

4. $E_y E_y^* E_x = (F_y + B_y + S_y)(F_y^* + B_y^* + S_y^*)(B_x + F_x + S_x) \rightarrow$

$$6\varepsilon_0 \chi_{1122} (F_y S_y^* B_x + B_y S_y^* F_x)$$

$$\rightarrow P_x = 6\varepsilon_0 \chi_{1221} F_x B_x S_x^* + 12\varepsilon_0 \chi_{1122} F_x B_x S_x^*$$

$$+ 6\varepsilon_0 \chi_{1221} F_y B_y S_x^* + B_y F_x S_y^* 6\varepsilon_0 \chi_{1122} + F_y B_x S_y^* 6\varepsilon_0 \chi_{1122}$$

$$= 6\varepsilon_0 (\overbrace{\chi_{1221} + 2\chi_{1122}}^{\chi_{1111}}) F_x B_x S_x^* + 6\varepsilon_0 \chi_{1221} F_y B_y S_x^*$$

$$+ 6\varepsilon_0 \chi_{1122} (B_y F_x + B_x F_y) S_y^* \rightarrow$$

$$P_x = 6\varepsilon_0 \{ \chi_{1111} F_x B_x + \chi_{1221} F_y B_y \} S_x^* + 6\varepsilon_0 \chi_{1122} (B_y F_x + B_x F_y) S_y^*$$

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$$P_y = 6\varepsilon_0 \chi_{1122}\{\underbrace{E_x E_x^* E_y}_{1} + \underbrace{E_y E_y^* E_y}_{2}\} + 3\varepsilon_0 \chi_{1221}\{\underbrace{E_x^2 E_y^*}_{3} + \underbrace{E_y^2 E_y \ldots}_{4}$$

1. $E_x E_x^* E_y = (F_x + B_x + S_x)(F_x^* + B_x^* + S_x^*)(F_y + B_y + S_y) \rightarrow$

$$6\varepsilon_0 \chi_{1122}(F_x S_x^* B_y + B_x S_x^* F_y)$$

2. $E_y E_y^* E_y = 2 F_y B_y S_y^*$ بطور مشابه $\rightarrow 6\varepsilon_0 \chi_{1122}(2 F_y B_y S_y^*)$

3. $E_x^2 E_y^* = F_x B_x S_y^* + B_x F_x S_y^* \rightarrow 3\varepsilon_0 \chi_{1221}(2 F_x B_x S_y^*)$

4. $E_y^2 E_y^* = (2 F_y B_y S_y^*) \rightarrow 3\varepsilon_0 \chi_{1221}(2 F_y B_y S_y^*)$

$$\rightarrow P_y = 6\varepsilon_0 F_y B_y \overbrace{(\chi_{1221} + 2\chi_{1122})}^{\chi_{1111}} S_y^* + 6\varepsilon_0 \chi_{1221} F_x B_x S_y^*$$

$$+ 6\varepsilon_0 \chi_{1122}(F_x B_y + B_x F_y) S_x^*$$

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$$\begin{cases} \dfrac{dA_3'}{dz} = iH A_4'^{*} \\ \dfrac{dA_4'}{dz} = -iH A_3'^{*} \end{cases} \longrightarrow A_4'(z) = B \sin|H|z + C\cos|H|z$$

$$A_3^{*\prime}(z=0) = A_3^{*}(0) \quad , A_4'(z=L) = A_4'(L)$$

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$$\longrightarrow A_3'^{*} = \frac{i}{H}\frac{dA_4'}{dz} = \frac{i}{H}\left(|H| B\cos|H|z - C|H|\sin|H|z\right)$$

$$\longrightarrow A_3'^{*}(z=0) = \frac{i}{H}|H|B \longrightarrow B = \frac{A_3^{*\prime}(0)\,H}{i|H|}$$

$$A_4(z=L) = \frac{A_3^{*\prime}(0)H}{i|H|}\sin|H|L + C\cos|H|L$$

$$\longrightarrow C = \frac{A_4'(L)}{\cos|H|L} - \frac{H A_3^{*\prime}(0)}{i|H|}\frac{\sin|H|L}{\cos|H|L}$$

$$\longrightarrow A_4'(z) = \underbrace{\left\{\frac{A_3^{*\prime}(0)H}{i|H|}\right\}}_{B}\sin|H|z + \underbrace{\left\{\frac{A_4'(L)}{\cos|H|L} - \frac{HA_3^{*\prime}(0)}{i|H|}\frac{\sin|H|L}{\cos|H|L}\right\}}_{C}\cos|H|z$$

$$= \frac{A_4'(L)}{\cos|H|L}\cos|H|z + \frac{HA_3^{*\prime}(0)}{i|H|\cos|H|L}\left(\sin|H|z\cos|H|L - \sin|H|L\cos|H|z\right)$$

$$= \frac{A_4'(L)}{\cos|H|L}\cos|H|z - \frac{iHA_3^{*\prime}(0)}{|H|\cos|H|L}\left(\sin(|H|(z-l))\right)$$

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$$A_3^{*} = A_3'^{*}(0)\cos|H|z - \left\{\frac{i|H|}{H}\frac{A_4'(L)}{\cos|H|L} - A_3'^{*}(0)\frac{\sin|H|L}{\cos|H|L}\right\}\sin|H|z$$

$$= -\frac{i|H|}{H}\frac{A_4'(L)\sin|H|z}{\cos|H|L} + \frac{A_3'^{*}(0)}{\cos|H|L}\left\{\cos|H|z\cos|H|L + \sin|H|L\sin|H|z\right\}$$

$$= -\frac{i|H|}{H}\frac{A_4'(L)\sin|H|z}{\cos|H|L} + \frac{A_3'^{*}(0)}{\cos|H|L}\left\{\cos(|H|(z-l))\right\}$$