

V. 倍频 传播方程 (频域)

$$\left(\frac{\partial^2}{\partial z^2} + k_{2z}^2\right) G_{2z}(k_{2x}, k_{2y}) = -\frac{\chi_{\text{eff}} k_2^2}{n_2^2} \sum_{l_x, l_y, l_z=-\infty}^{+\infty} C_{l_x, l_y, l_z} \cdot \iint \mathcal{F}[E_{10}(x, y)] \Big|_{k_x, k_y}^{x, y} \mathcal{F}[E_{10}(x, y)] \Big|_{k_{2x}-g_{l_x}-k_x, k_{2y}-g_{l_y}-k_y}^{x, y} e^{ik_{zQ}z} dk_x dk_y$$

VI. 泵浦 未耗尽 时, 频域解 $G_{2z}(k_{2x}, k_{2y})$ 和 空域解 $E_2(r)$

$$\left\{ \begin{aligned} G_{2z}(k_{2x}, k_{2y}) &= \frac{\chi_{\text{eff}} \omega_2^2}{c^2} \cdot \sum_{l_x, l_y, l_z=-\infty}^{+\infty} C_{l_x, l_y, l_z} \cdot \iint \mathcal{F}[E_{10}(x, y)] \Big|_{k_x, k_y}^{x, y} \mathcal{F}[E_{10}(x, y)] \Big|_{k_{2x}-g_{l_x}-k_x, k_{2y}-g_{l_y}-k_y}^{x, y} \frac{e^{ik_{zQ}z} - e^{ik_{2z}z}}{k_{zQ}^2 - k_{2z}^2} dk_x dk_y \\ &= \frac{d_{\text{eff}} \omega_2^2}{c^2} \frac{e^{ik_{2z}z}}{k_{2z}} \cdot \sum_{l_x, l_y, l_z=-\infty}^{+\infty} C_{l_x, l_y, l_z} \cdot \iint \mathcal{F}[E_{10}(x, y)] \Big|_{k_x, k_y}^{x, y} \mathcal{F}[E_{10}(x, y)] \Big|_{k_{2x}-g_{l_x}-k_x, k_{2y}-g_{l_y}-k_y}^{x, y} \frac{e^{i\Delta k_{zQ}z} - 1}{\Delta k_{zQ}} \frac{2}{\Delta k_{zQ}/k_{2z} + 2} dk_x dk_y \\ \text{其中, } \Delta k_{zQ} &= k_{zQ} - k_{2z} = \sqrt{k_1^2 - k_x^2 - k_y^2} + \sqrt{k_1^2 - (k_{2x} - g_{l_x} - k_x)^2 - (k_{2y} - g_{l_y} - k_y)^2} - \sqrt{k_2^2 - k_{2x}^2 - k_{2y}^2 + g_{l_z}} \\ E_2(x, y, z) &= \mathcal{F}^{-1} \left[G_{2z}(k_{2x}, k_{2y}) \right] \Big|_{k_{2x}, k_{2y}}^{x, y} \end{aligned} \right.$$