

[lex206] Maxwell stress tensor for linearly polarized plane wave

Consider a linearly polarized electromagnetic plane wave of the form,

$$\mathbf{E}(x, t) = E_0 \sin(kx - \omega t) \hat{\mathbf{j}}, \quad \mathbf{B}(x, t) = B_0 \sin(kx - \omega t) \hat{\mathbf{k}}, \quad E_0 = cB_0.$$

Determine all elements of the Maxwell stress tensor,

$$T_{kl} = \epsilon_0 [E_k E_l + c^2 B_k B_l - \frac{1}{2}(\mathbf{E} \cdot \mathbf{E} + c^2 \mathbf{B} \cdot \mathbf{B}) \delta_{kl}], \quad k, l = x, y, z$$

for this situation. Simplify each element as much as possible.

Solution: