物理学概論B (電磁気学)

第14回　Maxwell方程式と電磁波

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Maxwell方程式

$$\begin{cases} \mathrm{div}\,\overrightarrow{E} = \dfrac{\rho}{\epsilon_0} \\ \mathrm{div}\,\overrightarrow{B} = 0 \\ \mathrm{rot}\,\overrightarrow{E} = -\partial_t \overrightarrow{B} \\ \mathrm{rot}\,\overrightarrow{H} = \vec{j} + \partial_t \overrightarrow{D} \end{cases}$$

発散：
$$\begin{aligned} \mathrm{div}\,\overrightarrow{E} &= \overrightarrow{\nabla} \cdot \overrightarrow{E} \\ &= \left(\frac{\partial}{\partial x}, \frac{\partial}{\partial y}, \frac{\partial}{\partial z}\right) \cdot (E_x, E_y, E_z) \\ &= \frac{\partial E_x}{\partial x} + \frac{\partial E_y}{\partial y} + \frac{\partial E_z}{\partial z} \end{aligned}$$

回転：
$$\begin{aligned} \mathrm{rot}\,\overrightarrow{E} &= \overrightarrow{\nabla} \times \overrightarrow{E} \\ &= \left(\frac{\partial}{\partial x}, \frac{\partial}{\partial y}, \frac{\partial}{\partial z}\right) \times (E_x, E_y, E_z) \\ &= \left(\frac{\partial E_z}{\partial y} - \frac{\partial E_y}{\partial z},\ \frac{\partial E_x}{\partial z} - \frac{\partial E_z}{\partial x},\ \frac{\partial E_y}{\partial x} - \frac{\partial E_x}{\partial y}\right) \end{aligned}$$