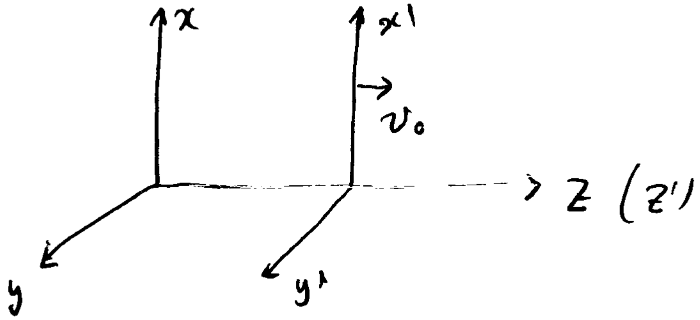
13-3 系の相対性変換

- z方向に v_0 で進む系への変換



Galilei 変換

$$\begin{cases} x' = x, \quad y' = y \\ z' = z + v_0 t \\ t' = t \quad (\text{時間は同じ}) \end{cases}$$

- Newton eq. は Galilei 変換において不変

$$\begin{cases} \ddot{x}' = \ddot{x}, \quad \ddot{y}' = \ddot{y} \\ \ddot{z}' = \ddot{z} \end{cases}$$

$$\therefore \quad m\ddot{\mathbf{r}} = \mathbf{F} \longrightarrow m\ddot{\mathbf{r}}' = \mathbf{F}'$$

No.

Date 85

[Maxwell eq. はどうか？]

$$\left(\nabla^2 - \frac{1}{c^2}\frac{\partial^2}{\partial t^2} \right) \mathbb{E}(\mathbf{r}, t) = 0$$

$$\begin{cases} z' = z + v_0 t \quad , x' = x, \quad y' = y \\ t' = t \end{cases}$$

$$\frac{\partial}{\partial z} = \frac{\partial}{\partial z'}\frac{\partial z'}{\partial z} + \frac{\partial}{\partial t'}\frac{\partial t'}{\partial z} = \frac{\partial}{\partial z'}$$

$$\frac{\partial}{\partial t} = \frac{\partial}{\partial z'}\frac{\partial z'}{\partial t} + \frac{\partial}{\partial t'}\frac{\partial t'}{\partial t} = v_0\frac{\partial}{\partial z'} + \frac{\partial}{\partial t'}$$

これより

$$\nabla^2 - \frac{1}{c^2}\frac{\partial^2}{\partial t^2} = \frac{\partial^2}{\partial x'^2} + \frac{\partial^2}{\partial y'^2} + \frac{\partial^2}{\partial z'^2} - \frac{1}{c^2}\left(v_0\frac{\partial}{\partial z'} + \frac{\partial}{\partial t'} \right)^2$$

$$\neq \nabla'^2 - \frac{1}{c^2}\frac{\partial^2}{\partial t'^2}$$ (一致しない)

不変ではない!!