$$\partial_t \underline{B} = \nabla \times (\underline{u} \times \underline{B}) + \eta \nabla^2 \underline{B}$$

Induction Equation

$$-\nabla \times (\eta \nabla \times \underline{B}) \qquad \eta \text{ const.}$$

$$\nabla \cdot \underline{B} = 0$$

$$\underline{B} = \nabla \times \underline{A}$$

$$\partial_t \nabla \times \underline{A} = \nabla \times (\underline{u} \times \underline{B}) - \nabla \times (\eta \nabla \times \underline{B})$$

$$\partial_t \underline{A} = \underline{u} \times \underline{B} - \eta \nabla \times \underline{B} + \nabla \Phi$$

Fix "gauge" (the value of Φ) using

$$\nabla \cdot \underline{A} = 0 \qquad \text{Coulomb gauge.}$$

$$-\nabla \times \underline{B} = -\nabla \times \nabla \times \underline{A} = \nabla^2 \underline{A}$$

$$\underline{u}_0 = Sx \qquad \underline{B}_0 = \underline{e}_z$$

$$\partial_t \underline{B}' = \nabla \times (\underline{u}_0 \times \underline{B}') + \nabla \times (\underline{u}' \times \underline{B}_0) + \nabla \times (\underline{u}' \times \underline{B}')$$

$$\partial_t \underline{B}' + \underline{u}' \cdot \nabla \underline{B}' = \underline{B}' \cdot \nabla \underline{u}' + \nabla \times (\underline{u}_0 \times \underline{B}') + \nabla \times (\underline{u}' \times \underline{B}_0)$$

$$-\underline{u}' \, \nabla \cdot \underline{B}' \qquad -\underline{B}' \, \nabla \cdot \underline{u}'$$