

Automatic Differentiation (x, z, t)

$$f = (\eta + 1)\frac{\partial^2 \hat{u}}{\partial x^2} + \frac{\partial^2 \hat{u}}{\partial z^2} + \eta \frac{\partial^2 \hat{v}}{\partial x \partial z} + (\eta + 1)\frac{\partial \hat{p}}{\partial x}$$

$$g = \frac{\partial^2 \hat{v}}{\partial x^2} + (\eta + 1)\frac{\partial^2 \hat{v}}{\partial z^2} + \eta \frac{\partial^2 \hat{u}}{\partial x \partial z} + (\eta + 1)\frac{\partial \hat{p}}{\partial z}$$

$$h = \frac{\partial^2 \hat{u}}{\partial t \partial x} + \frac{\partial^2 \hat{v}}{\partial t \partial z} - \frac{\partial^2 \hat{p}}{\partial x^2} - \frac{\partial^2 \hat{p}}{\partial z^2} - \beta Q$$

$$\mathcal{L} = MSE_{(u,v,p)} + MSE_{(f,g,h)}$$

Combined Loss from Training and Physical Constraints