$$\frac{\partial \boldsymbol{u}}{\partial t} = \mathcal{L}(\boldsymbol{x},t,\boldsymbol{u};\boldsymbol{\mu})$$
 Fom Linear ROM Nonlinear ROM
$$\bar{\boldsymbol{u}}(T)$$
 Full order model (FOM)
$$\boldsymbol{u}(\boldsymbol{x},t;\boldsymbol{\mu}) \approx g_{\text{FOM}}(\boldsymbol{x},\bar{\boldsymbol{u}}(t;\boldsymbol{\mu})) = \boldsymbol{\Phi}\cdot\bar{\boldsymbol{u}}(t;\boldsymbol{\mu})$$
 Linear POD-ROM
$$\bar{\boldsymbol{u}}(t;\boldsymbol{\mu}) \approx g_{\text{ROM}}'(\bar{\boldsymbol{u}}(t;\boldsymbol{\mu}) = \bar{\boldsymbol{u}}_0 + \mathbf{P}\cdot\tilde{\boldsymbol{u}}(t;\boldsymbol{\mu})$$
 Nonlinear ROM
$$\boldsymbol{u}(\boldsymbol{x},t;\boldsymbol{\mu}) \approx g_{\text{ROM}}(\boldsymbol{x},\tilde{\boldsymbol{u}}(t;\boldsymbol{\mu})) = \mathrm{NN}_{\theta}\left(\boldsymbol{x},\tilde{\boldsymbol{u}}(t;\boldsymbol{\mu})\right)$$