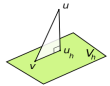
Modal Decomposition

$a_i(t) \quad \phi(\mathbf{x})$

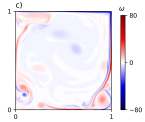
Galerkin Projection



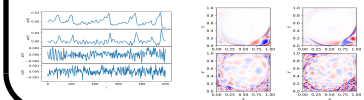
First Principle

$\partial_t \mathbf{u} + \mathbf{u} \cdot \nabla \mathbf{u} = -\nabla p + \frac{1}{Re} \nabla^2 \mathbf{u}$

$\mathbf{u}(t, \mathbf{x})$



$\bar{\mathbf{u}}(\mathbf{x}) + \sum_{i=1}^{N} a_i(t) \phi_i(\mathbf{x})$



$\dot{a}_i = C_i + L_{ij} a_j + Q_{ijk} a_j a_k$

$= \quad N^2 \quad + \quad N^3$