$$\mathbf{q} \in \mathbb{R}^{n}, \quad n >> 1, k$$

$$\mathbf{fOM} \xrightarrow{\mathbf{train}} \mathbf{Q} = \begin{bmatrix} | & | & | \\ \mathbf{q}_{t_{1}} & \mathbf{q}_{t_{2}} & \cdots & \mathbf{q}_{t_{k}} \\ | & | & | \end{bmatrix} \in \mathbb{R}^{n \times k} \xrightarrow{\mathbf{V}_{r}} \mathbf{V}_{r} \in \mathbb{R}^{n \times r} \xrightarrow{\mathbf{\hat{q}}} \hat{\mathbf{q}} \approx \mathbf{V}_{r}^{\top} \mathbf{q} \xrightarrow{\mathsf{reduce}} \mathbf{ROM}$$

$$\dot{\mathbf{q}} = \mathbf{f}(t, \mathbf{q}(t), \mathbf{u}(t))$$

$$\dot{\mathbf{q}} = \hat{\mathbf{f}}(t, \hat{\mathbf{q}}(t), \mathbf{u}(t))$$