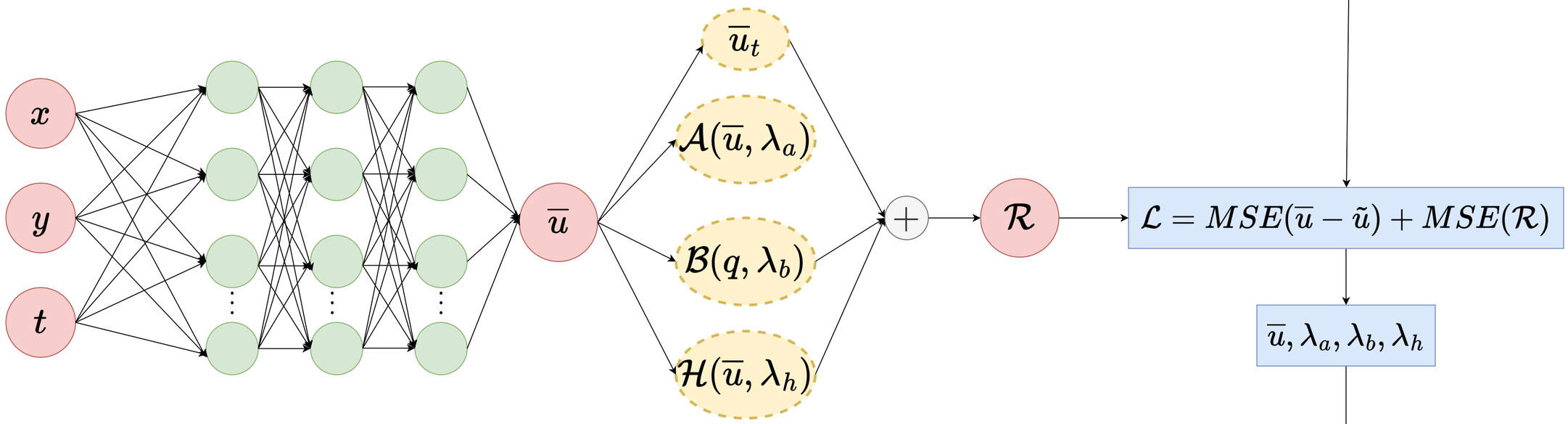
Noisy data

$\tilde{u}$



$\overline{u}$ Denoised data

Physics informed operator inference framework

$$\mathbf{Q} = \begin{bmatrix} | & | & & | \\ \mathbf{q}(t_0) & \mathbf{q}(t_1) & \dots & \mathbf{q}(t_k) \\ | & | & & | \end{bmatrix} \quad \overline{\mathbf{U}} = \begin{bmatrix} | & | & & | \\ \overline{\mathbf{u}}_0 & \overline{\mathbf{u}}_1 & \dots & \overline{\mathbf{u}}_k \\ | & | & & | \end{bmatrix}$$

$$\hat{\overline{\mathbf{U}}} = \mathbf{V}^\top \overline{\mathbf{U}}, \quad \hat{\dot{\overline{\mathbf{U}}}} = \mathbf{V}^\top \dot{\overline{\mathbf{U}}}$$

$$\min_{\hat{\mathbf{A}}, \hat{\mathbf{B}}, \hat{\mathbf{H}}} ||\hat{\dot{\overline{\mathbf{U}}}} - \mathbf{\Omega}\mathcal{D}||_F^2 + \zeta ||\mathbf{\Omega}||_F^2$$

$$\dot{\hat{\overline{\mathbf{u}}}}(t) = \hat{\mathbf{A}}\hat{\overline{\mathbf{u}}}(t) + \hat{\mathbf{H}}(\hat{\overline{\mathbf{u}}}(t) \otimes \hat{\overline{\mathbf{u}}}(t)) + \hat{\mathbf{B}}\mathbf{q}(t)$$

Reduced order model