$-\mu\Delta u + \underline{\beta} \cdot \nabla u = f(\underline{x}) \quad \underline{x} \in \Omega$

$BCs \qquad\qquad\qquad\qquad \underline{x} \in \partial\Omega$

$\forall \mu, \underline{\beta}$

$u_h(\underline{x}) \approx u(\underline{x})$

$\underline{x}, (\mu, \underline{\beta})$

$\{(\mu_i, \underline{\beta}_i)\}_{i=1}^{N}$

$u_{red}(\underline{x}, \mu, \underline{\beta})$

$u_h(\underline{x})$

a_1, a_2, a_3

w_1, w_2, w_3

$tanh(\sum_{i=1}^{3} a_i w_i)$

$tanh$

f

x_1

x_2

$u(\underline{x})$

$L(\underline{w})$

$\underline{w}_{opt} = \underset{\underline{w}}{argmin}\ L(\underline{w})$

$\underline{w}_{n+1} = \underline{w}_n - \eta \nabla L(\underline{w}_n)$

x_1

x_2

μ

$u(\underline{x}, \mu)$

$$L(\underline{w}) = \alpha_1 L_{Fit}(\underline{w}) + \alpha_2 L_{PDE}(\underline{w}) + \alpha_3 L_{BC}(\underline{w})$$

$L_{Fit}(\underline{w})$

$L_{PDE}(\underline{w})$

$L_{BC}(\underline{w})$