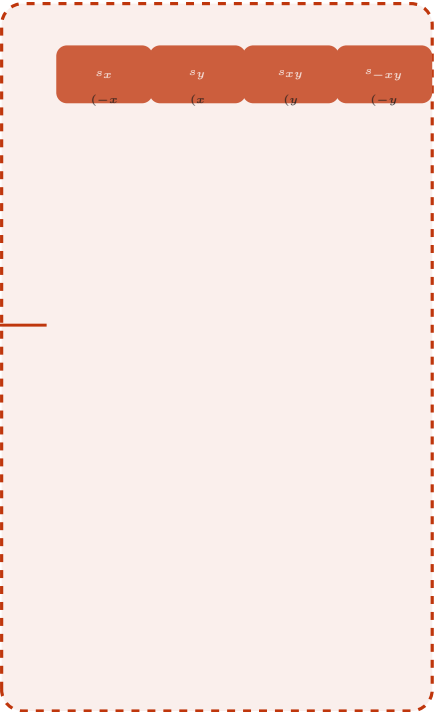




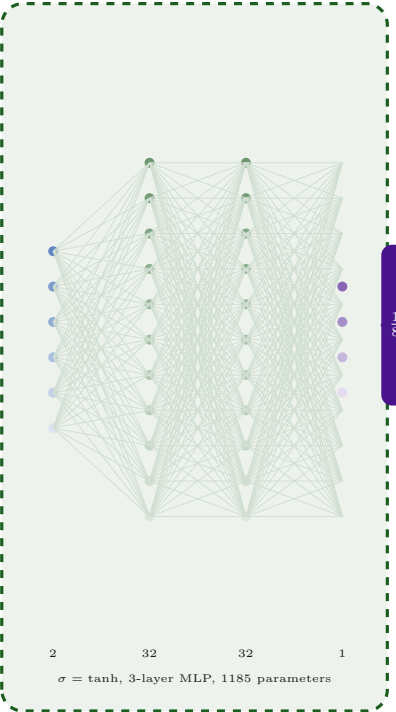
D_4 -PINN Computational Graph

D_4 Orbit Expansion – 8 Transformed Inputs Shared MLP f_θ (Applied to Each Orbit Element)

Input $\mathbf{x} = (x, y)$



$|D_4| = 8$ orthogonal 2×2 matrices



$\sigma = \tanh$, 3 layers, 1185 params, shared weights

$\frac{1}{8} \sum_{g \in D_4} f_\theta(g \cdot \mathbf{x})$ Reynolds Average

$u_\theta(\mathbf{x})$ D_4 -invariant

Theorem 1: $u_\theta(g' \cdot \mathbf{x}) = u_\theta(\mathbf{x}) \quad \forall g' \in D_4, \forall \theta$