

# Research Update

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February 3, 2025

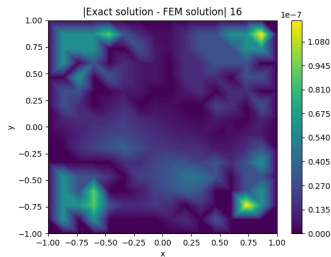
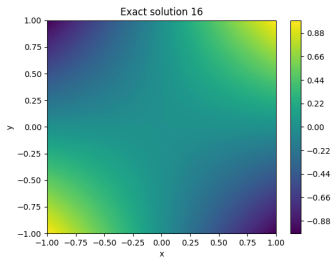
# Poisson 2D: The example

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$$

$$u(x, y) = xy$$

$$\forall -1 < x, y < 1$$

$$\text{for } x \text{ or } y = \pm 1$$



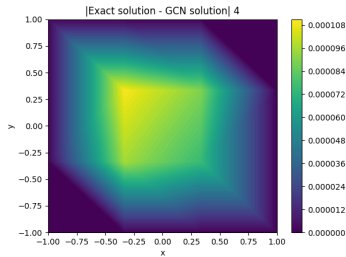
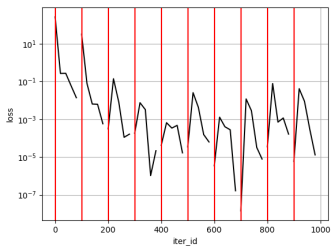
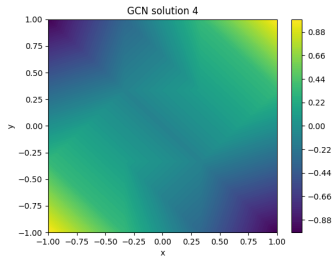
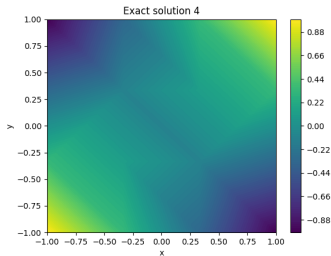
# Poisson 2D: Implementation

- Stiffness matrix  $K$
- Consistent load vector  $f$
- Adjacency matrix  $A$
- Degree array  $d$
- GCN layers: 1, 10, 10, 1
- num fits: 10
- iters per fit: 100
- learning rate:  $5 \times 10^{-2}$
- num check points: 5 per fit

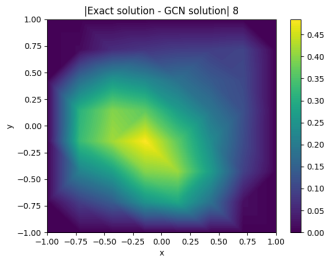
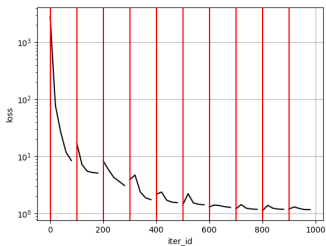
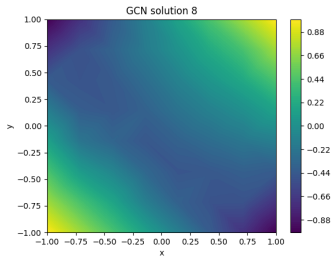
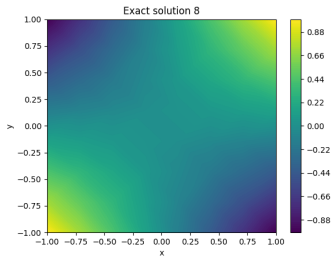
## Algorithm

- 1 Choose random solution  $u$
- 2 Initialise gcn
- 3 Fit gcn to for loss  $|Ku - f|_2^2$
- 4  $u \leftarrow \text{gcn}(u, A, d)$

# GCN run: $4 \times 4$ grid



# GCN run: $8 \times 8$ grid



# GCN run: $16 \times 16$ grid

