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Solving 3D Wave Equation with Physics-Informed Neural Networks
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Equation:
∂²u/∂t² = c²(∂²u/∂x² + ∂²u/∂y² + ∂²u/∂z²)
Wave speed c = 1.0

Domain:
Space: [0.0, 1.0]³
Time:  [0, 1]

Initial Conditions:
u(x,y,z,0) = sin(πx)sin(πy)sin(πz)
∂u/∂t(x,y,z,0) = 0

Boundary Conditions:
Dirichlet: u = 0 on all spatial boundaries
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Starting training...
Epoch     0 | Train Loss: 2.59e-01 | Val Loss: 3.09e+00 | LR: 1.0e-03
Epoch  1000 | Train Loss: 7.41e-02 | Val Loss: 7.35e-02 | LR: 1.0e-04
Epoch  2000 | Train Loss: 6.74e-02 | Val Loss: 6.74e-02 | LR: 1.0e-04
Epoch  3000 | Train Loss: 5.53e-02 | Val Loss: 5.60e-02 | LR: 1.0e-04

Training completed in: 11920.53 seconds
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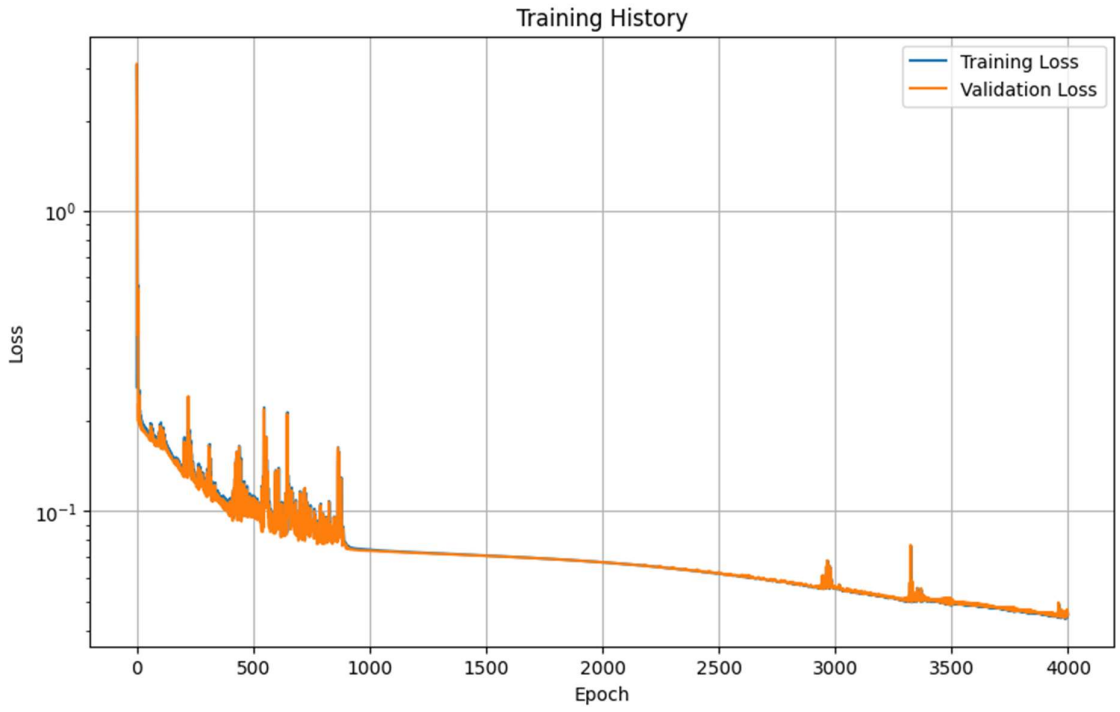
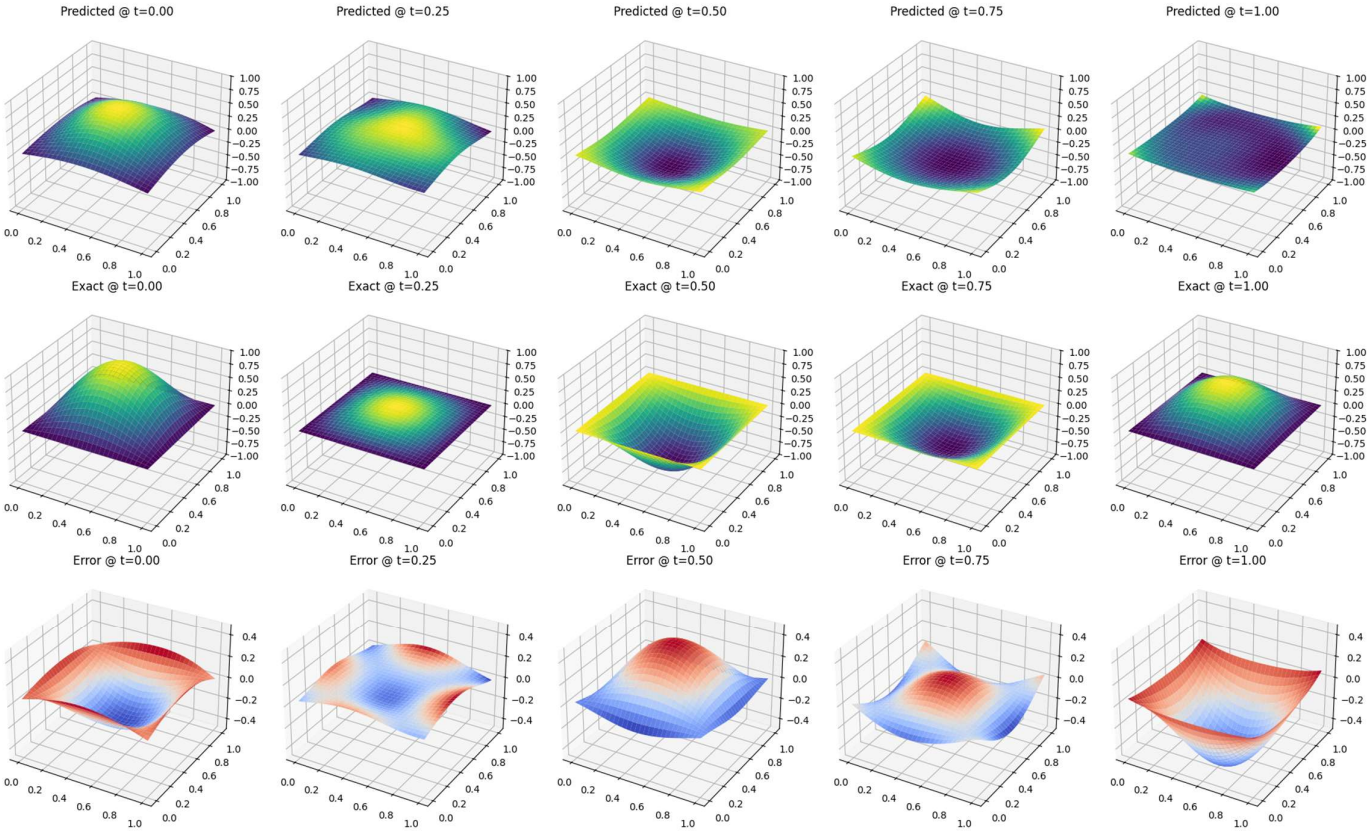
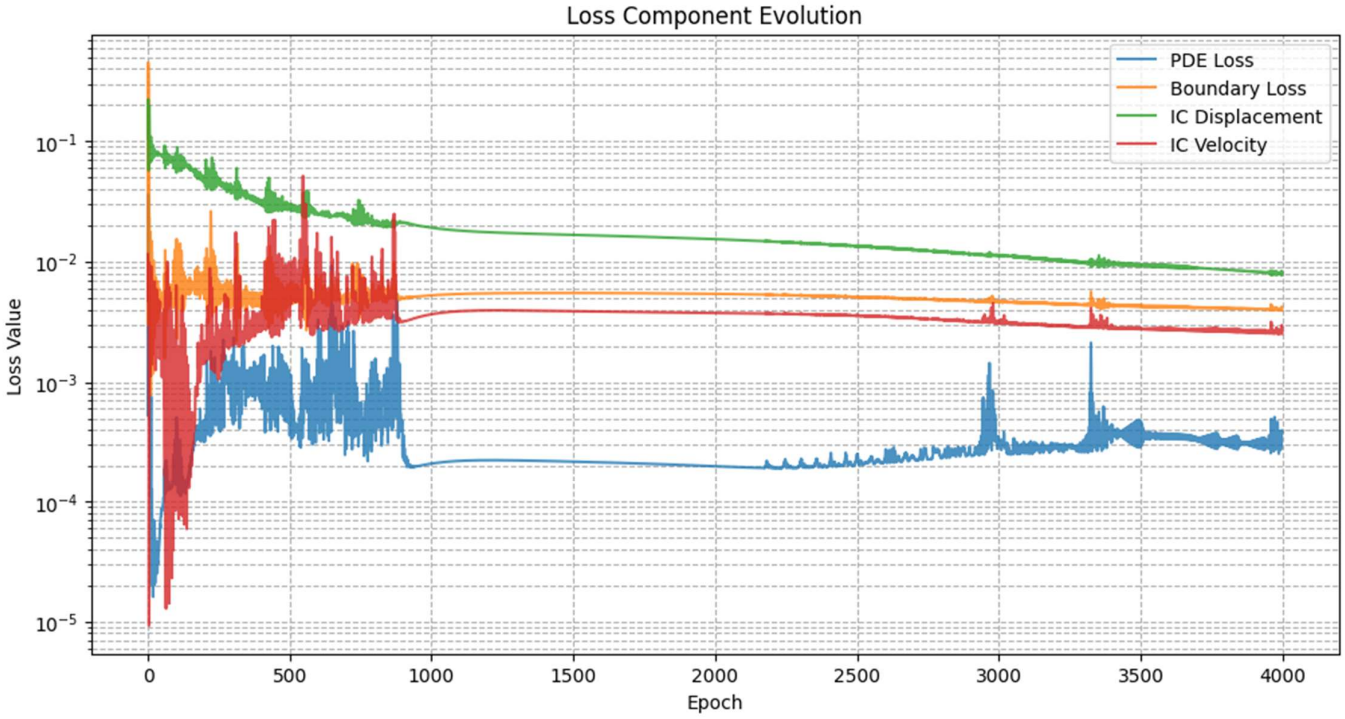
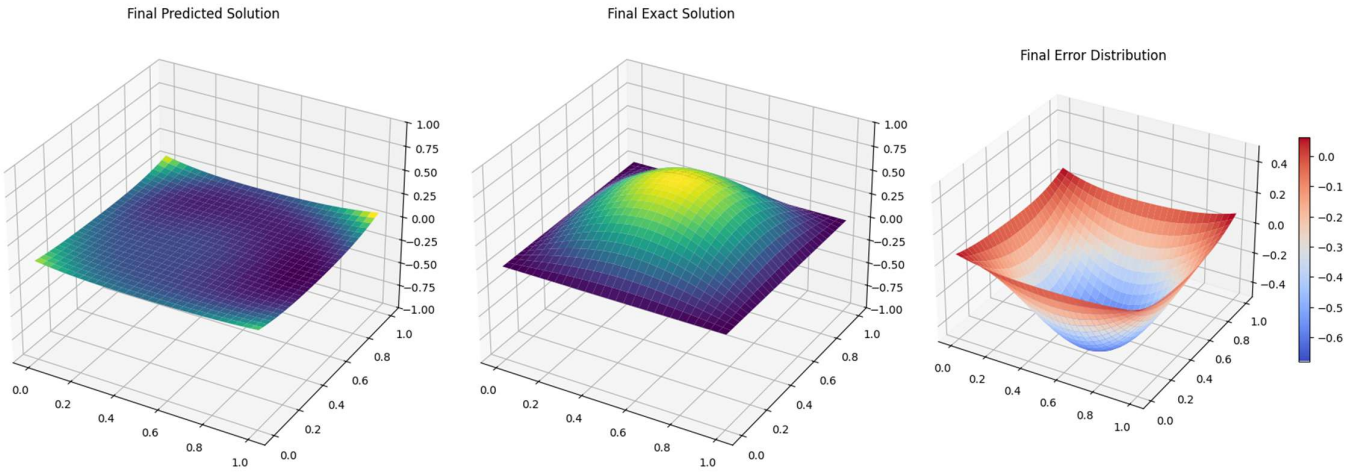



Predicted @ t=0.00
Predicted @ t=0.25
Predicted @ t=0.50
Predicted @ t=0.75
Predicted @ t=1.00
Exact @ t=0.00
Exact @ t=0.25
Exact @ t=0.50
Exact @ t=0.75
Exact @ t=1.00
Error @ t=0.00
Error @ t=0.25
Error @ t=0.50
Error @ t=0.75
Error @ t=1.00


Loss Component Evolution
PDE Loss
Boundary Loss
IC Displacement
IC Velocity
Loss Value
Epoch

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Final Error Metrics:
RMSE: 3.3673e-01
R² Score: -1.8160
Max Absolute Error: 6.8004e-01
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