2 order Finite Difference Method

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Grid size: 11x11

Grid spacing: dx = 0.1, dy = 0.1

Program execution started....

Setting boundary conditions...

Setting interior points...

Matrix initialization completed.

Total equations: 121

Boundary points: 40

Interior points: 81

Iteration = 0, Convergence error = 1.650e+001, L1 error = 5.737e+000

VTK document output: FDM_diffusion_2D_11x11_000000.vtk

Steady state reached!

Final iteration: 101, Convergence error: 7.105e-015

Final L1 error: 8.915e-004

VTK document output: FDM_diffusion_2D_11x11_000101.vtk

Grid size 11x11 computation completed

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Grid size: 21x21

Grid spacing: dx = 5.000e-002, dy = 5.000e-002

Program execution started....

Setting boundary conditions...

Setting interior points...

Matrix initialization completed.

Total equations: 441

Boundary points: 80

Interior points: 361

Iteration = 0, Convergence error = 1.650e+001, L1 error = 7.482e+000

VTK document output: FDM_diffusion_2D_21x21_000000.vtk

Steady state reached!

Final iteration: 241, Convergence error: 9.571e-009

Final L1 error: 2.503e-004

VTK document output: FDM_diffusion_2D_21x21_000241.vtk

Grid size 21x21 computation completed

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Grid size: 41x41

Grid spacing: dx = 2.500e-002, dy = 2.500e-002

Program execution started....

Setting boundary conditions...

Setting interior points...

Matrix initialization completed.

Total equations: 1681

Boundary points: 160

Interior points: 1521

Iteration = 0, Convergence error = 1.650e+001, L1 error = 8.699e+000

VTK document output: FDM_diffusion_2D_41x41_000000.vtk

Steady state reached!

Final iteration: 922, Convergence error: 9.975e-009

Final L1 error: 6.587e-005

VTK document output: FDM_diffusion_2D_41x41_000922.vtk

Grid size 41x41 computation completed

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Grid size: 81x81

Grid spacing: dx = 1.250e-002, dy = 1.250e-002

Program execution started....

Setting boundary conditions...

Setting interior points...

Matrix initialization completed.

Total equations: 6561

Boundary points: 320

Interior points: 6241

Iteration = 0, Convergence error = 1.650e+001, L1 error = 9.406e+000

VTK document output: FDM_diffusion_2D_81x81_000000.vtk

Iteration = 1000, Convergence error = 7.483e-004, L1 error = 6.345e-002

Iteration = 2000, Convergence error = 7.213e-006, L1 error = 5.949e-004

Iteration = 3000, Convergence error = 6.952e-008, L1 error = 1.105e-005

Steady state reached!

Final iteration: 3418, Convergence error: 9.988e-009

Final L1 error: 1.610e-005

VTK document output: FDM_diffusion_2D_81x81_003418.vtk

Grid size 81x81 computation completed

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Data file output: grid_convergence_data.dat

Gnuplot script output: plot_convergence.plt

=== Grid Convergence Analysis ===

Linear regression results:

Slope = 1.930 (理論值應接近 2.0)

Intercept = -2.545

Order of accuracy = 1.930

Correlation coefficient R = 0.9997

R2 = 0.9995

To generate the plot, run: gnuplot plot_convergence.plt

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VTK document output: Analytical_solution_81x81_000000.vtk

All computations completed!