360.242 **Numerical Simulation and Scientific Computing I**, 2024W

Exercise #3: Task 2

Group 05

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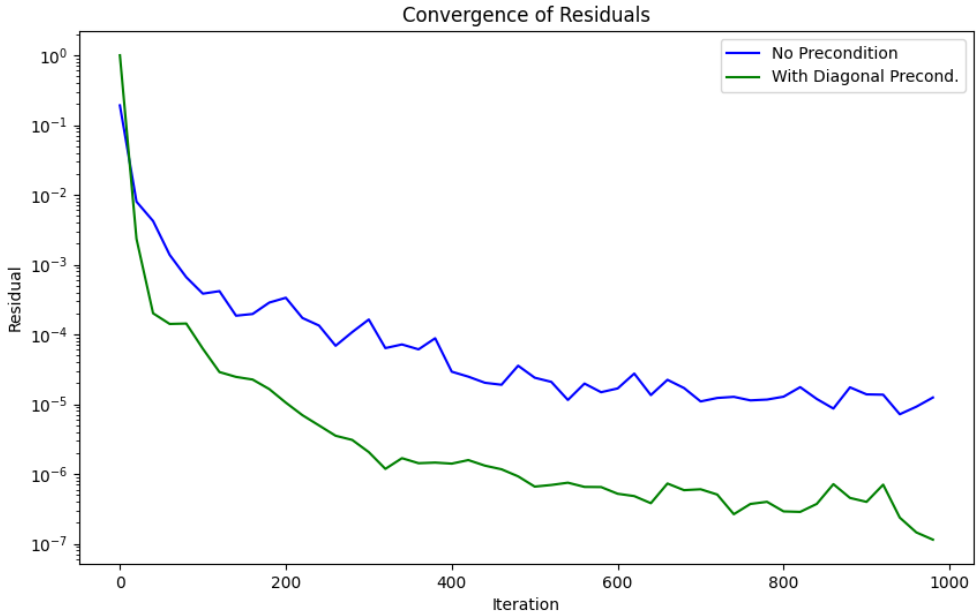
2 Conjugate Gradients in Eigen

The graph shows the convergence of residuals for two methods: the implementation of task 1 of the Conjugate Gradient (CG) method without preconditioning and Eigen's CG method with a diagonal preconditioner.



From the plot, it's clear that preconditioning significantly improves the convergence rate. Without preconditioning, the residual decreases more slowly. In contrast, the diagonal

preconditioner helps Eigen's CG method converge faster and more smoothly to a smaller residual norm. This indicates that the diagonal preconditioner reduces the condition number of the matrix, making the solver more efficient.
The implementation without preconditioning of task 1 performs well but takes more iterations to reduce the residual to a similar level. This shows that preconditioning is a useful technique to improve solver performance, especially for matrices like BCSSTK11.

Build and Run

1. **make clean**: cleans up generated files
2. **make all**: compiles programme defined in `main.cpp`