

Report 4: Partial Differential Equations (PDEs)

Simon BLAUE

December 9, 2022

Universität Göttingen
Faculty of Physics
Instructor: Prof. Dr. S. Schumann
Tutors: Dr. E. Bothmann, M. Knobbe

1 Laplace Equation

1.1 Iterator methods

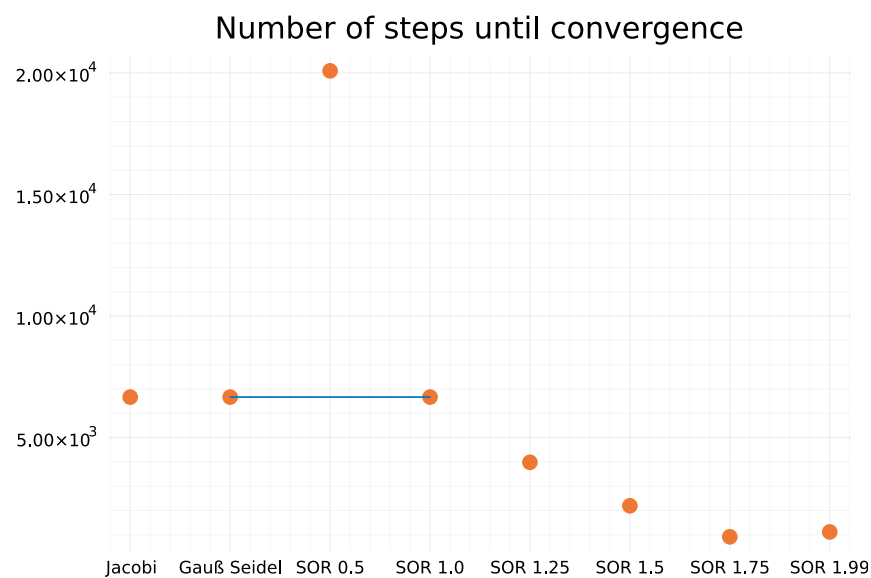


Figure 1: Number of steps until convergence concerning the Laplace error $\max \epsilon < 1 \times 10^{-3}$.

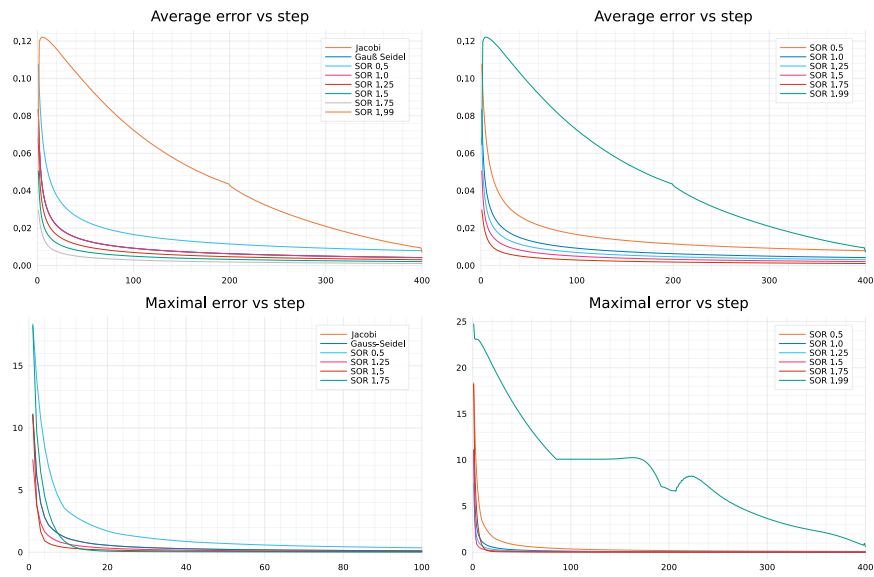


Figure 2: Maximal and average error for different iteration methods.

1.2 SOR for $\alpha = 2.0$

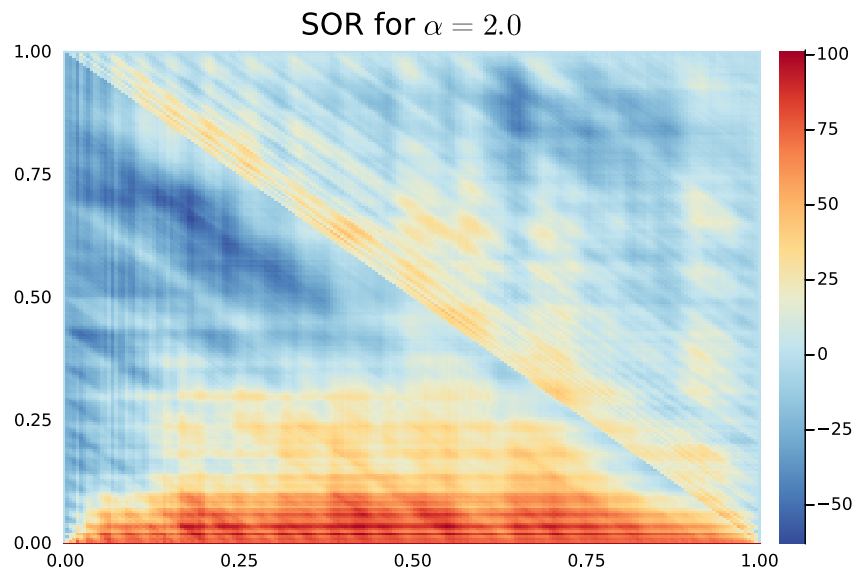


Figure 3

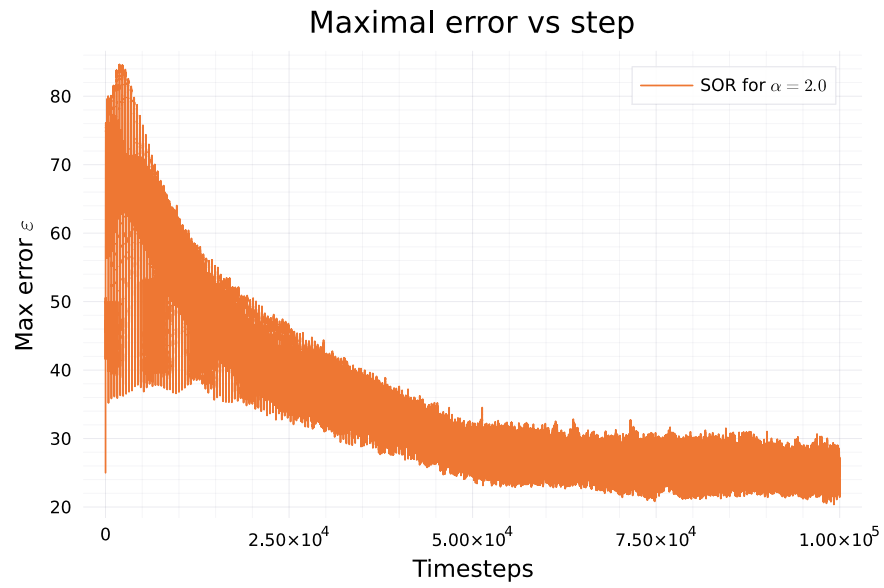


Figure 4

1.3 Infinite sum solution

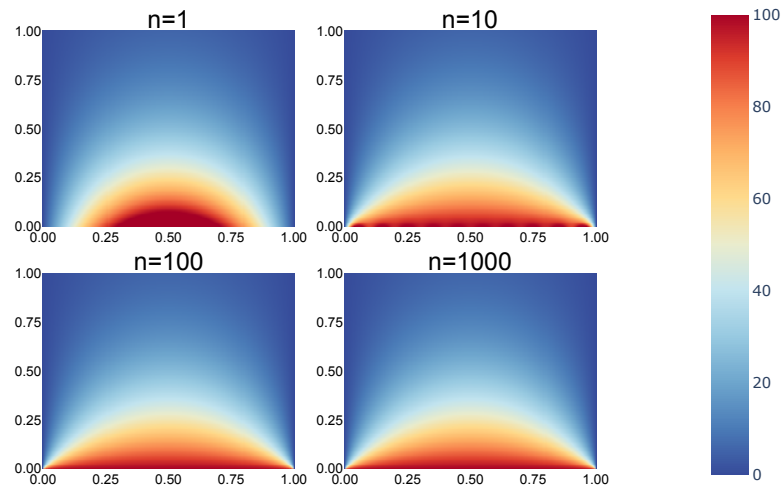
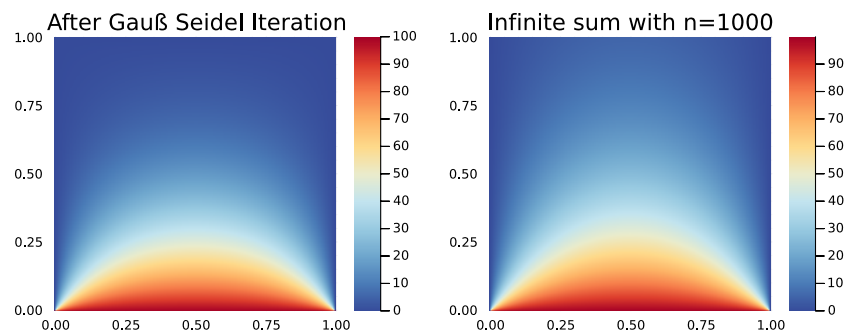
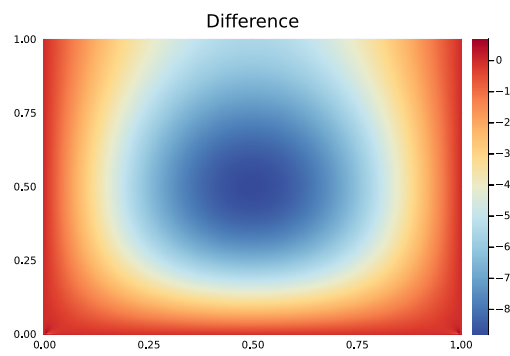


Figure 5: Results for the "infinite" sum solution to the Laplace equation for different numbers of terms n .



(a) Comparison of the infinite sum solution with 1000 terms and the Gauß Seidel iterator solution.



(b) Difference between the infinite sum solution with 1000 terms and the Gauß Seidel iterator solution.

2 Diffusion

2.1 Integration methods

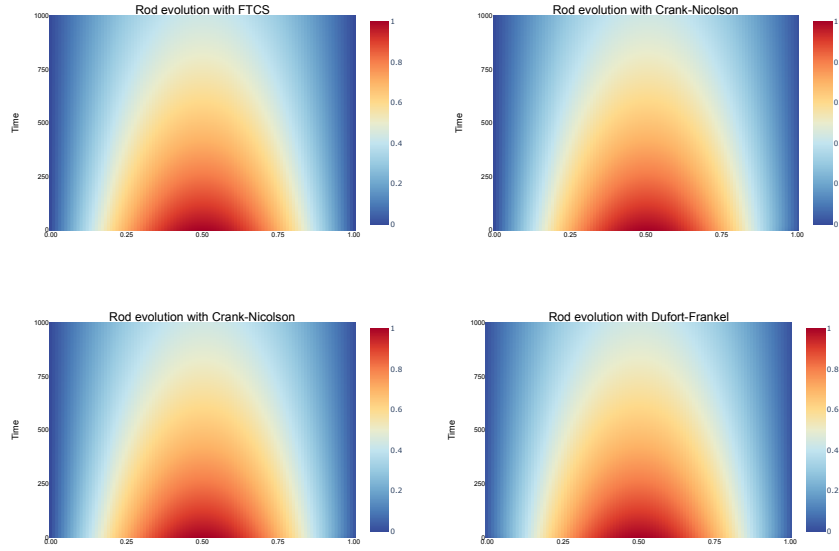


Figure 7: Temporal evolution of the rod's temperature along the y-axis. The evolution seems to be the same for all four integration methods.

2.2 Error comparison

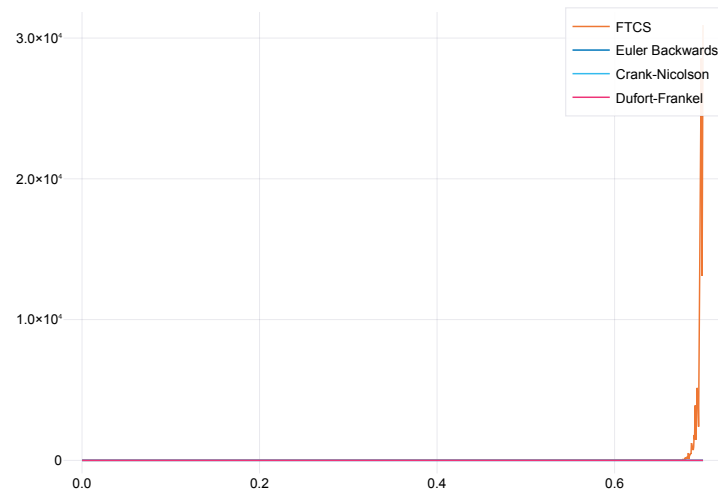


Figure 8

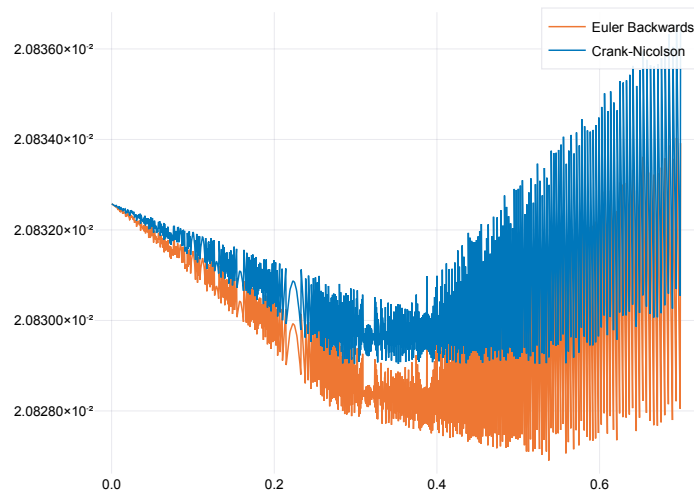


Figure 9

TODO: Dufort Franke not so nice

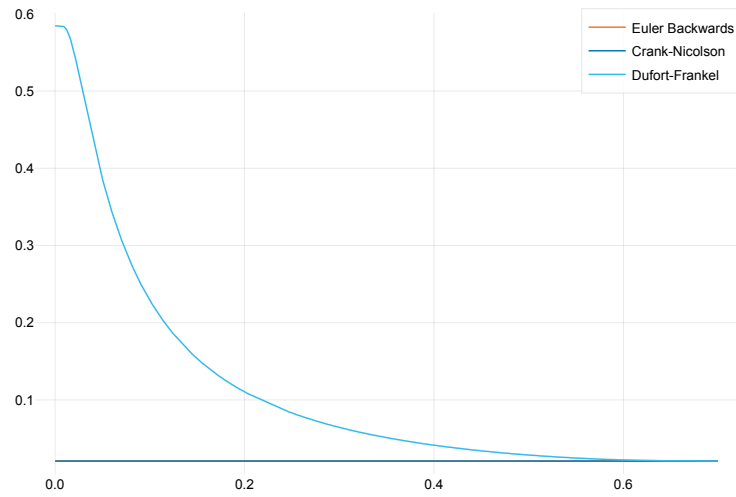


Figure 10

3 Solitons