Exercise 8

Introduction to Computational Astrophysics, SoSe 2024

Seha Lee

Task 1. *Numerical integration of a time series*

Solution. From log-log plane it is observed that there are linear relations for both the trapezoid rule and Simpson's rule, the latter being considerably smaller.
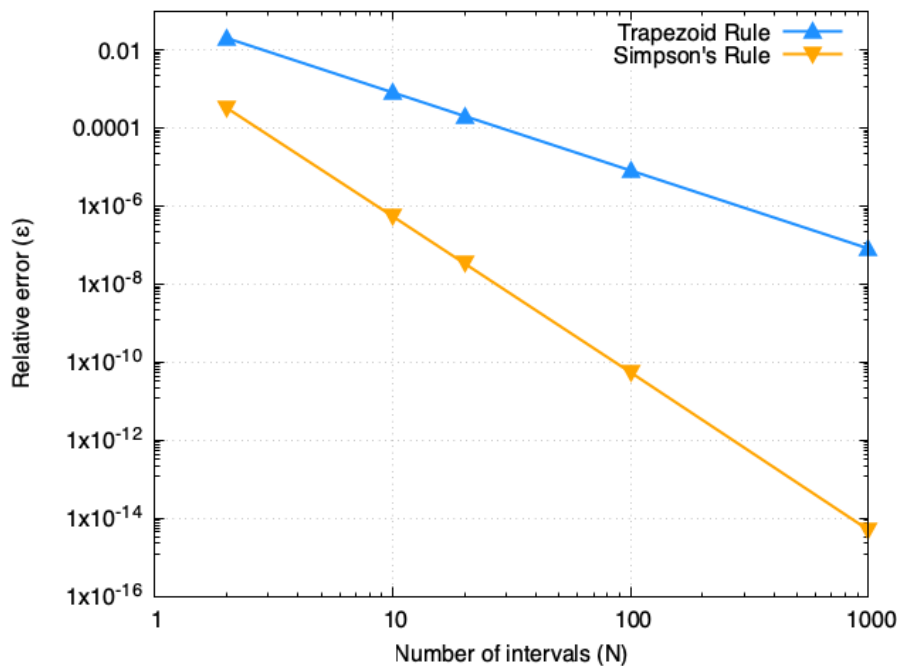

Figure 1: Task 1

Task 2. *Numerical integration II*

Solution. The function $\sin(100x)$ oscillates rapidly due to the high frequency, alternating between positive and negative values. These values are supposed to cancel each other to result in 0, but tiny numerical errors can accumulate if not enough points are used. The result of calculation of F1 is mostly 0.

The function $\sin^x(100x)$ fluctuates drastically when x in not small enough, so it is difficult to calculate the integrated value. In figure 3, -1 denotes "not a number" value.

$\square$

Task 3. *Shooting method*

Here I have tried the shooting method but unfortunately there is a discrepancy with the analytic method.
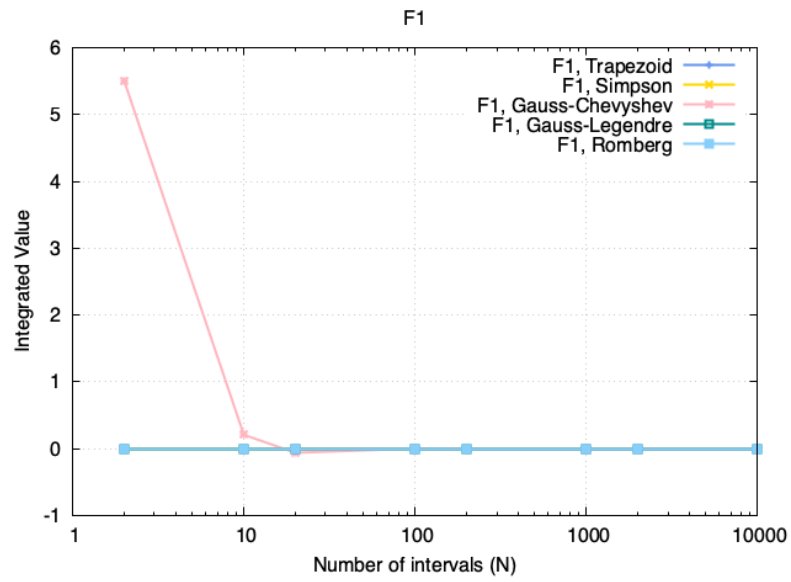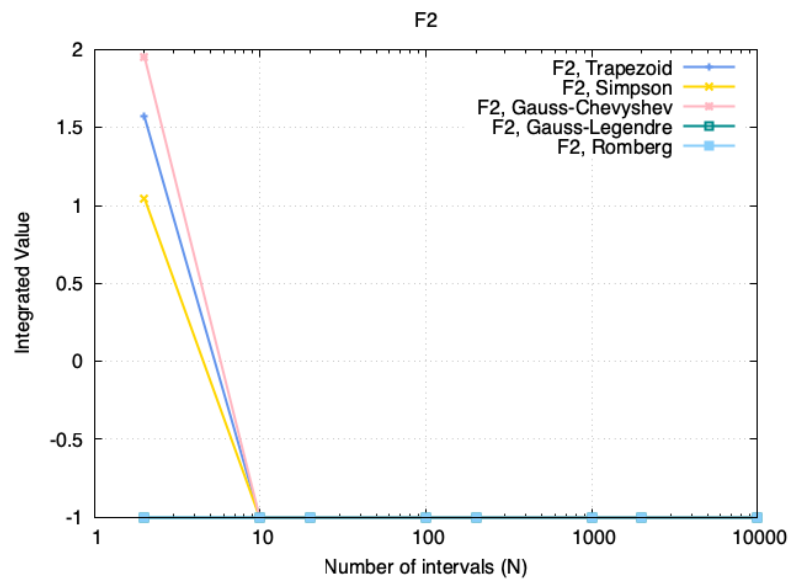
Solution. $\square$
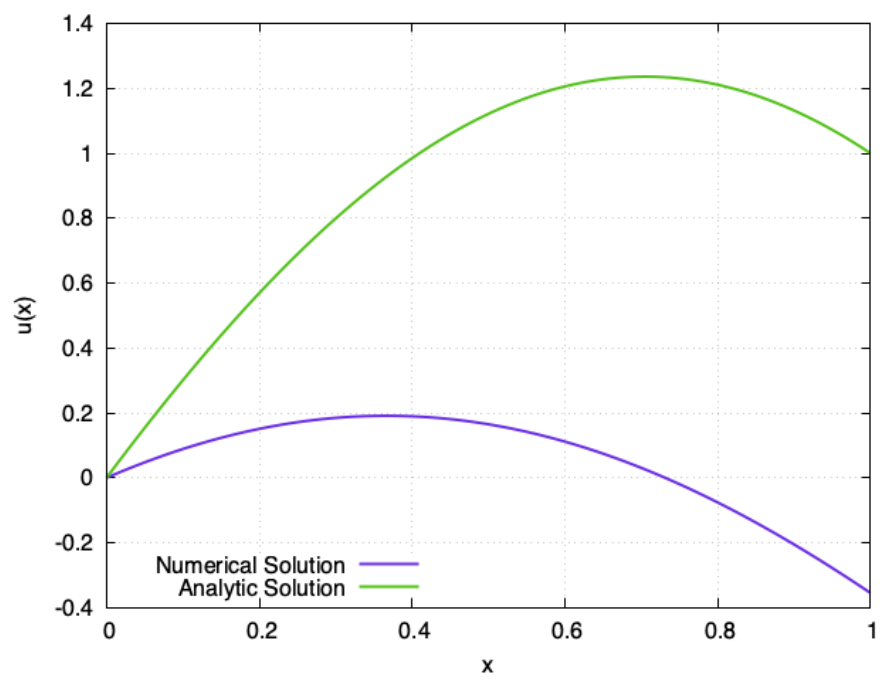
Figure 2: Task 2: F1

Figure 3: Task 2: F2

Figure 4: Task 3