

Exercise session on numerical integration, 3

October 15, 2021

Exercise 1

Consider the definite integral

$$I = \int_0^{\pi} \sin x \, dx = 2.$$

Compute numerical approximations of I with the trapezoidal formula, using 20 and 40 subintervals. Compute an approximation of I by Richardson extrapolation of the two previously computed values. Compare the accuracy of this approximation with that of the Simpson formula employed with 40 subintervals.

Exercise 2

Consider the definite integral

$$I = \int_0^3 \exp(-x^2) \sin(3x) \, dx.$$

Write a script that computes automatically a numerical approximation by the trapezoidal formula with an estimated absolute error of 10^{-9} , using an error estimator obtained by Richardson extrapolation.

Exercise 3

Extend the MATLAB functions of Exercise 1 of the previous exercise session to compute automatically numerical approximations of a generic definite integral with an estimated absolute error of ϵ using an error estimator obtained by Richardson extrapolation.