Integrations (Mode Decomposition exercise)

December 23, 2024

1 Code structure

- Definition of three functions f_1, f_2, and f_3

- Definition of the function $simpson3\_8$ for implementing Simpson's 3/8 rule

  - if $MOD(m, 3) = 0$ then apply Simpson's 3/8 rule over the whole interval
  - if $MOD(m, 3) = 1$ then apply Simpson's 3/8 rule up to the third to the last subinterval; then apply Simpson's 1/3 rule to the last two subintervals.
  - if $MOD(m, 3) = 2$ then apply Simpson's 3/8 rule up to the penultimate subinterval; then apply the trapezoidal rule for the last subinterval.
  - the errors are computed accordingly

- Definition of a function for implementing the Gauss-Legendre quadrature of order 2.

- Definition of three functions needed to calculate the errors ($error3\_8$, $error1\_3$, $error\_trap$)

- Regarding the error associated with Gauss-Legendre quadrature we take the difference between our approximation and exact result.

- Definition of a subroutine for creating documents.

- We store the errors and log(h) values, and create the related documents.

We make use of a python code to plot the data.