ESO 208A: Computational Methods in Engineering

Tutorial 8

Cubic splines

1. Consider the function $f(x) = \exp(x)$ sampled at points $x = 0,\ 0.5,\ 1.0,\ 1.5$ and 2. Estimate the function value at $x = 1.80$ by interpolating the function using - (a) natural cubic spline and (b) not-a-knot cubic spline. Calculate the true percentage error for both the splines. Which is the better spline for this problem and why?

Numerical integration

2. Estimate the following integral both analytically and numerically. For numerical integration use trapezoidal and Simpson's 1/3 rules by dividing the range of integration into 1, 2, 4, and 8 segments. Compute true percentage errors for numerical integration. Also calculate the ratio of errors for each successive interval sizes.

$$I = \int_0^2 \exp(x)\mathrm{d}x$$