SIF3012 Computational Physics
2025-2026 Semester 1
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CONTINUOUS ASSESSMENT PART 1

Exercise 1

Obtain the temperature distribution along a rod shown in Figure 1 where its thermal behaviour can be modeled by the equation

$$\frac{d^2T}{dx^2} + \alpha(T_\alpha - T) = 0$$

with boundary conditions $T(0) = 40^\circ C$ and $T(L) = 200^\circ C$. Use $L = 10m$, $\alpha = 0.01m^{-2}$, $T_\alpha = 20^\circ C$ and a step size of $h = 2m$.

Compute the analytical solution of the ODE and compare the numerical results with it.

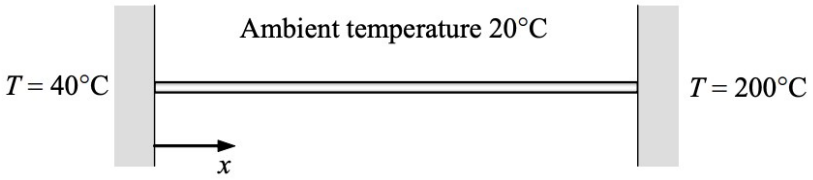

Fig. 1: A rod having thermal losses through convection.

Exercise 2

As a person who likes plants and flowers, I found a very beautiful lilly image and I wanted to keep a copy for myself. However, due to bad printer quality and the of the material of the original format, the scanned image appeared quite corrupted (see Figure 2). Collect the image from Spectrum (see AlternativeAssessment.png) and load it into python. Using the FFT method to remove periodic undesired noise patterns, but applied to the 2D image, obtain a de-noised picture of the lilly.

HINT: Do not flag the central (brightest) point, as it is the first term of the Fourier Transform, that gives the average luminosity of the whole image.

Figure 2: A noisy picture of a lilly