

Department of Chemical Engineering, IIT Kharagpur

CH49019: CAPE Laboratory Autumn 2021

Assignment 4: Due on October 3, 2021

Email Your Assignment (pdf only) to

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1. Consider the following BVP representing a dimensionless form of the diffusion with chemical reaction in a catalyst pore.

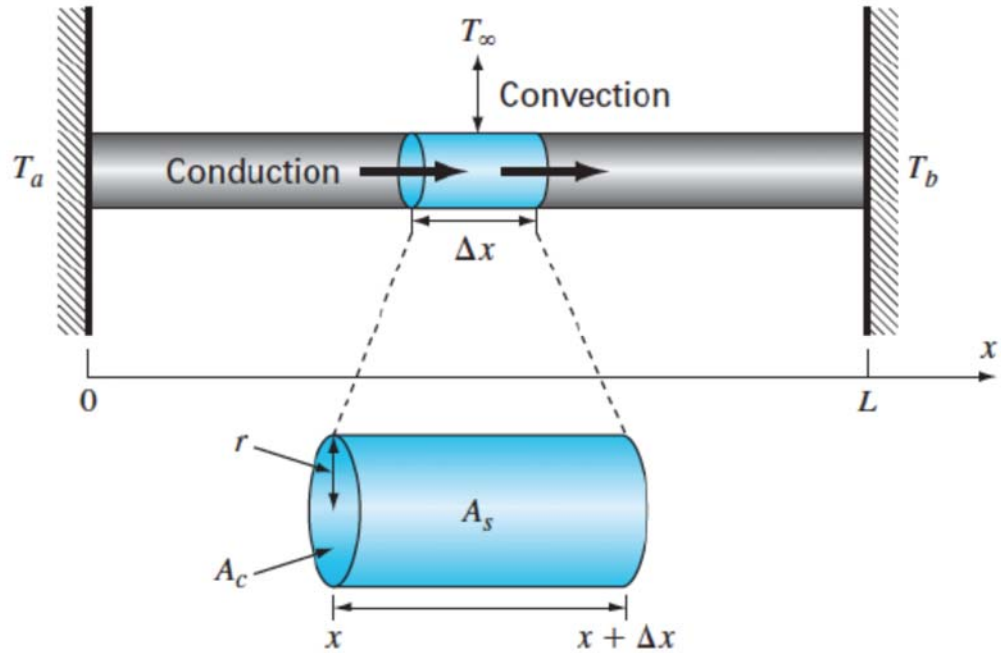
$$\frac{d^2c}{dx^2} = 4c$$

At $x = 0$ (the mouth of the pore), the dimensionless concentration, $c = 1$.

At $x = 1$ (the pore end), the gradient of the concentration, $dc/dx = 0$.

Solve the BVP using (a) Shooting Method (your code) and (b) MATLAB function `bvp4c`. Plot the concentration profile along pore length x and compare the results.

2. Consider the following BVP representing steady state Heat Transfer in a rod of length $L = 10$ m.



$$\frac{d^2 T}{dx^2} + h'(T_\infty - T) + \sigma(T_\infty^4 - T^4) = 0$$

Given: $h' = 0.05 \text{ m}^{-2}$, $\sigma = 2.7 \times 10^{-9} \text{ K}^{-3} \text{ m}^{-2}$

$T_\infty = 200 \text{ K}$, $T(0) = 300 \text{ K}$, $T(10) = 400 \text{ K}$.

Solve the BVP using (a) Shooting Method (your code) and (b) MATLAB function `bvp4c`. Plot the temperature distribution along the length of the rod and compare the results.