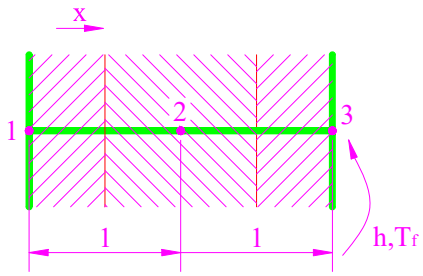
homework3-Numerical Heat Transfer

习题 4－2

Figure as shown below, is one-dimensional steady-state heat conduction problem, where T_1=100 ,λ = 5, S =150 , T_f= 20 , h =15 are known, the unit of every item is in System International (SI) . Try to determine the value of T_2 , T_3 by numerical calculation, according to your results, to prove that the entire computational domain meets the requirements of the overall conservation even if only three nodes were took.



习题 4－3

A large plate with thickness of 0.1 m, uniform source $S = 50 \times 10^3 W/m^3$, λ = $10W/(m \cdot ℃)$; One of its wall is kept at 75 ,while the other wall is cooled by a fluid with T_f = 25℃ and heat transfer coefficient $h = 50W/m^2 \cdot ℃$. Divide the plate thickness into three uniform elements, and by using Practice A, determine the inner node temperature. Take 2nd order accuracy for the inner node, and 1st order / 2nd order accuracy (two cases) for the right boundary node.

习题 4－12

Write a program using TDMA algorithm, and use the following method to check its accuracy: set arbitrary values of the coefficients A_i , B_i andC_i(i =1,10) . But B_1 and C_{10} should not be zero. Then setting the reasonable values of temperatureT_1 ,..., T_{10}, calculate the corresponding constants D_i . Apply your program for solving T_i by using the values of A_i , B_i , C_i and D_i , and compare the results with the given value.

习题 4－14

According to the problem discussed in section 4.6(The fully developed heat convection in a circular tube), try to analyze the following three dimensionless temperature definitions of $\Theta = \frac{T - T_w}{T_b - T_w}, \Theta = \frac{T - T_\infty}{T_w - T_\infty}, \Theta = \frac{T - T_w}{T_\infty - T_w}$, which one is acceptable for separation of variables.

习题 4－19

Shown in Fig.4-25 is a channel for cooling an electronic device :laminar fluid flow and heat transfer in the direction normal to the page are fully developed, and the top and bottom wall have uniform heat fluxes q_1 and q_2, respectively. Try:

(1) Determine the domain for numerical simulation and give mathematical formulation;

(2) Propose a numerical method which can be sued to simulate the dimensionless temperature distributions of the channel at different ratio of q_1 / q_2