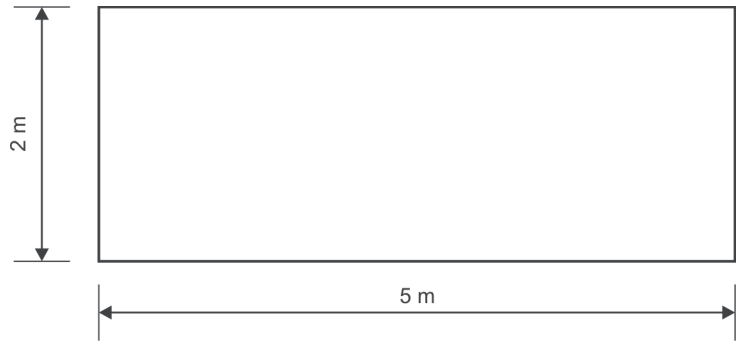
Experiment 1

One-Dimensional Steady State Diffusion

AIM

To solve the one-dimensional steady state diffusion for a given problem using Workbench and Fluent to study the results.

PROBLEM SPECIFICATION



Consider a rectangular section having width W = 5 m and height H = 2 m. The following conditions are applied to analyse this problem.

	Case I	*Case II*	*Case III*
Left wall	Temperature = 600 K	Heat flux = 500 W/m²	Heat flux = 500 W/m²
Right wall	Temperature = 300 K	Temperature = 300 K	Convective heat transfer coefficient = 25 W/m²K Temperature = 300 K

PROCEDURE

Preprocessor

All the steps are carried out using Workbench.

Model Creation

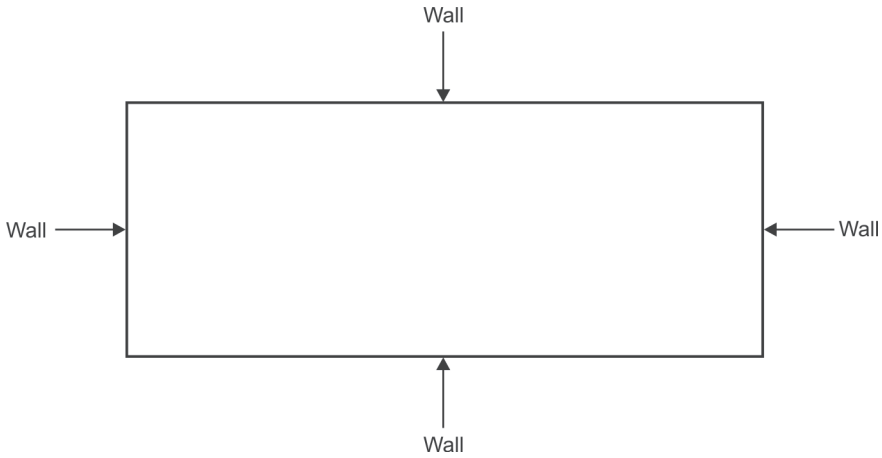
1. Vertices are created using (0,0), (5,0), (5,2) and (0,5)
2. Edges are created using the above vertices
3. Select all the edges and convert them to faces

Meshing

1. Horizontal top and bottom edges are meshed
2. Vertical left and right side edges are meshed

Specification of Boundary Types

Edge	*Name*	*Type*
Left	Left wall	Wall
Right	Right wall	Wall
Top	Top wall	Wall
Bottom	Bottom wall	Wall



1. The continuum is specified as solid
2. Export the mesh file with export 2D mesh option select
3. The mesh file has been saved as plate mesh

Processor

1. The meshed file is read to Fluent case file
2. Energy equation is selected as this problem involves in temperature distribution (Laplace equation is solved $K\ (d^2T/dx^2) = 0$)
3. Steel has been selected as material

Boundary Condition

1. Temperature of 600 K is applied at the left edge and 300 K is applied at the right edge (case I)

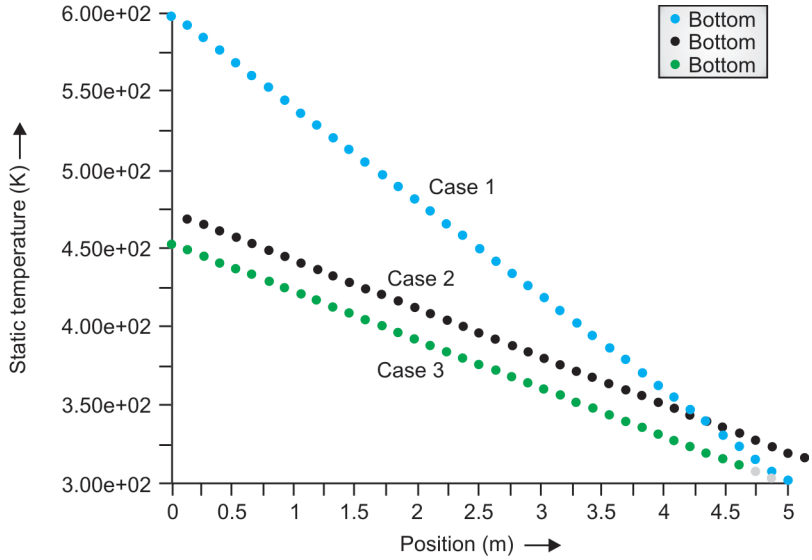
2. The solution is initialised from inlet
3. The solution is obtained by iterative process and is converged

Postprocessor

1. The graph is plotted between length of the plate on x-axis and the temperature at the wall on y-axis
2. Then the boundary conditions are changed in processor and postprocessor are repeated
3. Comparative graphs are drawn for various boundary conditions

Inference

From the graph, it is evident that the temperature decreases consistently from high temperature side.



Static temperature ANSYS fluent 15.0 (2d.dp.pbns. lam)

RESULT

The given problem is solved using Workbench and Fluent and the results are drawn for different boundary conditions.