2D Buoyant turbulent flow

Abstract:

In this study, turbulent buoyant flow in a square enclosure is analysed to study thermal and turbulent properties. The k-ω turbulence model is used with QUICK, van Leer and UMIST schemes for discretising the convective term. The solver used in this study is the ***buoyantSimpleFoam***. Buoyant flow has important application in the study of ventilation, passive cooling of electronic equipments, etc., however, the flow pattern generated by it is complex and least understood. The results of the simulation are compared with the experiment of Ampofo and Karayiannis (2003).

Problem statement:

A square enclosure of dimensions 0.75 × 0.75 m^2 is kept at a constant temperature of 50°C on the left wall and 10°C on the right wall, while the top and bottom walls are adiabatic. Temperature, velocity and turbulent kinetic energy in the boundary layer are determined.

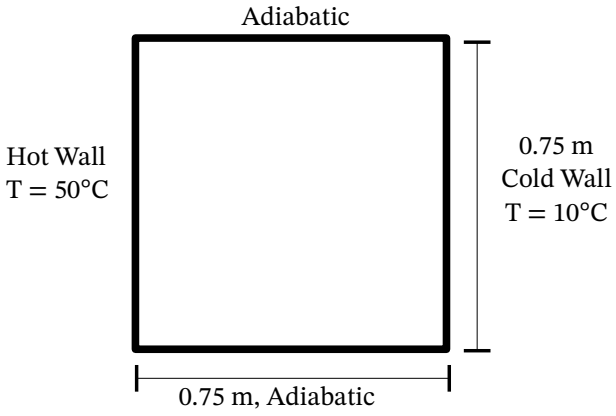

Figure 1: Description of the square enclosure.

Table1: Properties of air	
Molecular weight	28.9 g/mol
Dynamic viscosity (μ)	1.8689×10^{-5} Pa.s
Specific heat (Cp)	1006.7 kJ/kg.K
Prandtl (Pr)	0.7

1. Ampofo F. and Karayiannis T.G., Experimental benchmark data for turbulent natural convection in an air filled square cavity, International Journal of Heat and Mass Transfer, 46 (2003) 3551-3572.