

Appendix D

Definition of boundary conditions

User-defined Database

Parameters of nanofluids

Definition of each boundary condition

The velocity inlet boundary condition defines flow entering the physical domain of the model, FLUENT uses both the velocity components and the scalar quantities that you defined as boundary conditions to compute the inlet mass flow rate, momentum fluxes, and fluxes of energy and chemical species. The mass flow rate entering a fluid cell adjacent to a velocity inlet boundary is computed as

$$\dot{m} = \int \rho \vec{v} \cdot d\vec{A}$$

A heat flux boundary condition at a wall, you specify the heat flux at the wall surface. FLUENT uses your input of heat flux to determine the wall surface temperature adjacent to a fluid cell as

$$T_w = \frac{q - q_{rad}}{h_f} + T_f$$

where h_f is fluid-side local heat transfer coefficient, T_w is wall surface temperature, T_f is local fluid temperature, q_{rad} is radiative heat flux. Note that the fluid-side heat transfer coefficient is computed based on the local flow-field conditions (e.g., turbulence level, temperature, and velocity profiles)

The static pressure at the pressure outlet boundary, enter the appropriate value for gauge pressure in the pressure outlet panel. This value will be used for subsonic flow only. Should the flow become locally supersonic, the pressure will be extrapolated from the upstream conditions. The pressure gradient is given by

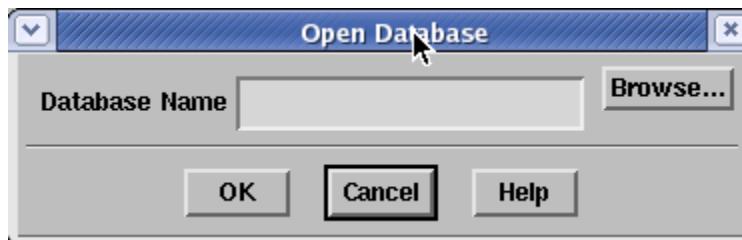
$$\frac{\partial p}{\partial r} = \frac{\rho v_\theta^2}{r}$$

where r is the distance from the axis of rotation and v_θ is the tangential velocity.

Define materials through “User-defined Database”

STEP: Open **User-Defined Database...**

Load Text File



Sample command in Text file

```

////////////////////////////////////
;;;                               ;;;
;;;          FLUENT USER DEFINED MATERIAL DATABASE          ;;;
;;;                               ;;;
;;; (name type[fluid/solid] (chemical-formula . formula)    ;;;
;;;      (prop1 (method1a . data1a) (method1b . data1b))    ;;;
;;;      (prop2 (method2a . data2a) (method2b . data2b)))   ;;;
;;;                               ;;;
////////////////////////////////////

(
  (alumina fluid
    (chemical-formula . al2o3<1>)
    (specific-heat (constant . 880))
    (density (constant . 3970))
    (viscosity (constant . 0.0016))
    (thermal-conductivity (constant . 40))
  )
)

```

