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PART 1 – CONTROLLED TEST SETUP

Test case : **Turbulent long duct flow – 2000/1/2**
Document Version 1.0

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Case: **Turbulent long duct flow – 2000/1/2**

User details	
Run by: Date: Phone no: email:	Address:

Fire modelling Software

SMARTFIRE	CFX	PHOENICS			

Version/build number_____
Date of release_____

Operating System

Windows 95/98/2000	Windows NT	Unix	Dos	

Version/build number_____

Machine

PC	Unix Workstation	

CPU:
Memory:

Case description

This test case examines the CFD fire modelling software's κ-ε turbulence model in conjunction with turbulent heat transfer. This case has been well investigated numerically. The geometry of the case is depicted in Figure 1. The flow is non buoyant, fully turbulent, incompressible with heat transfer but no radiation. Flow enters the inlet at 50m/s with an enthalpy of 50 J/Kg. The wall has a fixed enthalpy value of 1 J/Kg. The fluid density is 1.0 kg/m^3, the conductivity is 0.07179 W/mK, the density is 1.0 kg/m^3, laminar viscosity is 5e-5 kg/ms, specific heat is 1005 J/kgK

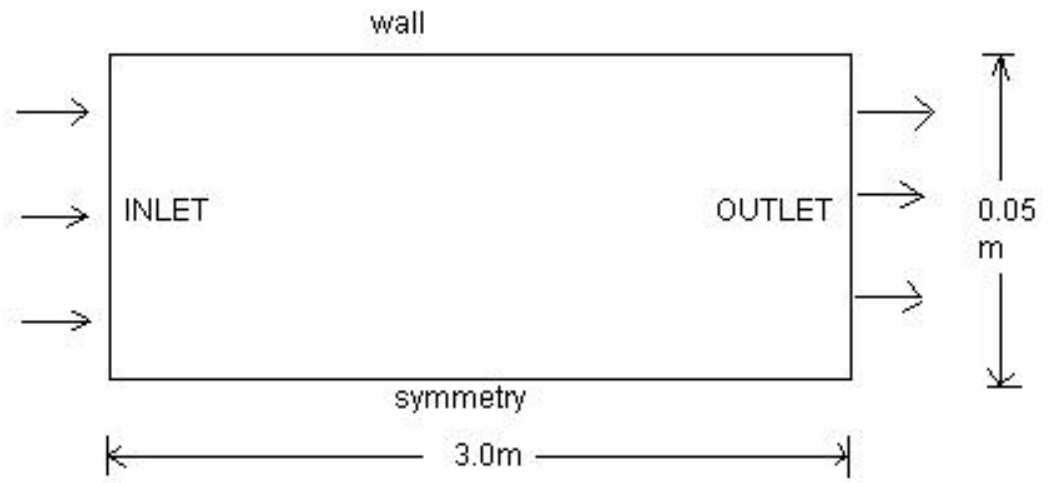

Figure 1 - Turbulent long duct flow configuration

Required Results
The results should be supplied as graphs and as Excel97 worksheets
This case is used to compare between codes.
An enthalpy and u-velocity profile at the outlet need to be provided.

CFD set up

1D	2D	3D

Transient	Steady State

Differencing Schemes

Temporal:

Fully Implicit	Crank-Nicolson	Explicit	Exponential	

Spatial:

Hybrid	Central Difference	Upwind		

Notes:

Physical Models

Radiation Model (if not listed please specify in the space provided)

None	Six flux	Discrete Transfer	Monte Carlo	Radiosity	

Notes:

Parameters

Turbulence model *(if not listed please specify in the space provided)*

Laminar	k- ε	buoyancy modified k-ε	RNG	

Notes:

Turbulence Parameters*:

C_μ	σ_k	σ_ε	$C_{1\varepsilon}$	$C_{2\varepsilon}$	C_3
0.09	1.0	1.3	1.44	1.92	1.0

*If different parameters are being used please specify in the table above.

Combustion Model *(if not listed please specify in the space provided)*

none	Volumetric heat source	Mixed is burnt	Eddy break up
Magnussen soot model			

Combustion Parameters:

Compressibility

Incompressible	Boussinesq	Weakly compressible	Fully compressible

Compressibility Parameters:

Buoyancy

Yes	No

Gravity	0.0m/s

Material Properties

Material Name	Air
Density	1.0
Laminar Viscosity	5e-05

Conductivity	0.07179
Specific heat capacity	1005.0

Initial Values

U-VELOCITY	50.0
V-VELOCITY	0.0
W-VELOCITY	0.0
PRESSURE	0.0
TEMPERATURE	293.75
KINETIC ENERGY	11.25
DISSIPATION RATE	1387.0

Boundary conditions

Inlet

Velocity : 50 m/s
Turbulent kinetic energy: 11.25 (m^2/s^2)
Dissipation rate: 1378.0 (m^2/s^3)
Enthalpy: 10 (J/kg)

Wall

Fixed enthalpy value :(1 J/kg).
Standard turbulent wall functions on the wall

Outlet

Pressure : 0.0 Pa

Mesh

Mesh data

The mesh is non-uniformly distributed and the cell budget is 600(20×30x1).

X
0.0 0.15 0.3 0.45 0.6 0.75 0.9 1.05 1.2 1.35 1.5 1.65 1.8 1.95 2.1 2.25 2.4 2.55 2.7 2.85 3.0
Y
0.0 0.003901 0.00656 0.008891 0.011033 0.013042 0.014953 0.016786 0.018554 0.020268 0.021935 0.02356 0.025149 0.026705 0.028231 0.02973 0.031205 0.032656 0.034087 0.035497 0.036889 0.038264 0.039623 0.040966 0.042295 0.04361 0.044912 0.046201 0.047479 0.048745 0.05

Z
0.0 1.0

Model Definition files

Convergence

Please specify your convergence criteria including type of error estimator and tolerance value for each variable

Runtime

Results files/Archiving:

Document cross-reference:

User Guides, etc

Comments