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PART 1 – CONTROLLED TEST SETUP

Test case : **Symmetry boundary condition test – 2000/1/3**
Document Version 1.0

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Case: **Symmetry boundary condition test – 2000/1/3**

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 case is intended to test if the symmetry function works correctly for turbulent isothermal flow. The case involves flow expansion from a small duct into a larger duct. The configuration is shown in Figure 1 below. The case was simulated using the whole flow domain and then repeated using a symmetry boundary condition along the central axis. Two tests must be conducted using the full domain and using a half domain with a symmetry plane. The results from these two tests should agree with one another. The flow enters the domain at 1.0m/s.

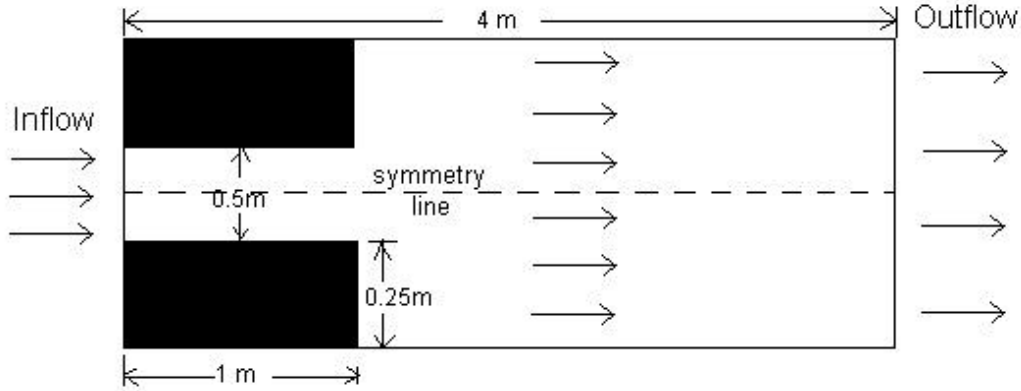


Figure 1 - Expanding duct with symmetry line indicated

Required Results

The results should be supplied as graphs and as Excel97 worksheets

This case is specifically designed for testing the symmetry treatment of each case. A whole field velocity vector plot should be supplied for both cases along with a u-velocity profile at the outlet for both cases.

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:

External Pressure 1.01325e+05 Pa

Buoyancy

Yes	No

Gravity	0.0m/s

Material Properties

Material Name	Air
Density	Determined by compressibility (Ideal Gas Law) Molecular Weight of air is 29.35

Viscosity	Laminar 1.798e-005kg/m.s + Value determined from turbulence model
Conductivity	0.02622 W/m.K
Specific heat capacity	1007.0 J/kg.K

Initial Values

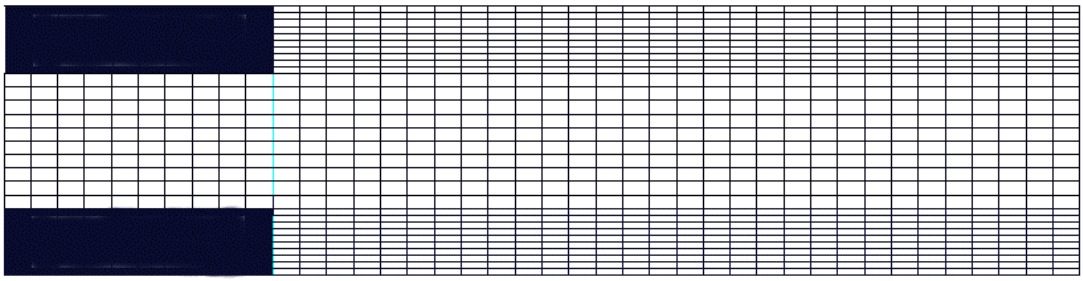
U-VELOCITY	0.0
V-VELOCITY	0.0
W-VELOCITY	0.0
PRESSURE	0.0
TEMPERATURE	n/a
KINETIC ENERGY	0.01
DISSIPATION RATE	0.01

Boundary conditions

Inlet
U-velocity:1.0 m/s
Dissipation rate:0.01
Kinetic energy:0.01

Outlet: (Pressure boundary) 0.0 Pa

Mesh



Half

40 15 1
X
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3 3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8 3.9 4.0
Y

```
0.0 0.05 0.1 0.15 0.2 0.25 0.275 0.3 0.325 0.35 0.375 0.4
0.425 0.45 0.475 0.5
Z
0.0 1.0
```

Whole

40 30 1

```
X
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 1.1 1.2 1.3 1.4
1.5 1.6 1.7 1.8 1.9 2 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3
3.1 3.2 3.3 3.4 3.5 3.6 3.7 3.8 3.9 4.0
Y
0.0 0.025 0.05 0.075 0.1 0.125 0.15 0.175 0.2 0.225 0.25
0.3 0.35 0.4 0.45 0.5 0.55 0.6 0.65 0.7 0.75 0.775 0.8
0.825 0.85 0.875 0.9 0.925 0.95 0.975 1
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