CHAM Limited
Pioneering CFD Software for Education & Industry

PHOENICS Demonstration Example using PHOENICS-3.6.2 [2006]

## Pressure Loss Study – Flow through an Exhaust Duct

Introduction

Following a request received through CHAM's Spanish agents, Aertia Software, a demonstration case was created on behalf of their customer, Ingenieria, Diseño y Análisis (IDA).

IDA was concerned with the overall and intermediate pressure losses occurring within ducting through which high-temperature gas was exhausted, together with its outlet velocity. The study was undertaken as part of a CFD code-comparison review.

Model Description

The geometry was supplied in the form of an IGES file that was converted into the .STL format more readily accepted by PHOENICS.
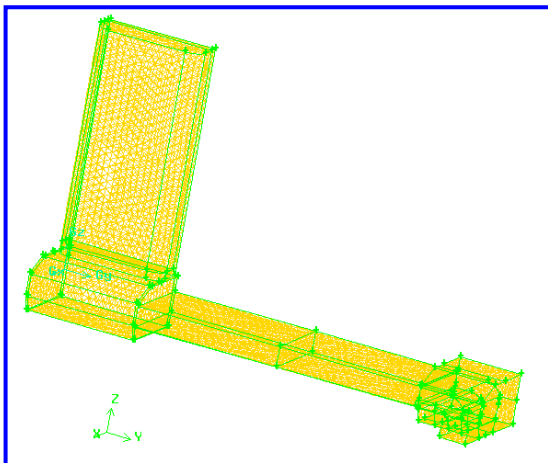
The following boundary conditions were provided:

Flow: 6.7 Kg / s

Gas temperature: 371 ºC

Desired Loss of Pressure: 125 mm c.a. (presumed to be:1226 Pa)

Geometry of Exhaust Duct
as supplied by the client

Modelling Assumptions:

For demonstration purposes, the following assumptions were made:

- Only half of geometry modelled due to symmetry - mass flow is thus 3.35 Kg/s;
- Fluid is air at roughly 1bar and 371°C, giving a density of 0.54kg/s;
- Temperature is assumed constant;
- KE-Chen turbulence model used;
- Splitter plates at entrance to vertical duct modelled as solid wedge.

Results:

Calculated average pressure at inlet plane: 1509 Pa above atmosphere. The exit is at atmospheric pressure, so the pressure drop through the device is 1509 Pa.

Average velocity near the exit plane is 34.9 m/s.

Results show considerable swirling flow in the vertical duct leading to the exit. Animated results can be found by clicking on: here and here and here.

Velocity, m/s
158.8987
148.9918
139.0848
129.1778
119.2709
109.3639
99.45695
89.54999
79.64303
69.73606
59.82910
49.92214
40.01517
30.10821
20.20125
10.29429
0.387325

Aertia Demo - PHOENICS

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Pressure, Pa
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1920.760
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271.7852
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