
Contract No.:
GTC1-CT99-10030

A THEMATIC NETWORK FOR QUALITY AND TRUST
IN THE INDUSTRIAL APPLICATION OF CFD

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Code:
D29_V1_TA2-AC07_P43 AC Quality Review Checklist

QNET-CFD

*A Thematic Network for Quality and Trust
in the Industrial Application of
Computational Fluid Dynamics*

D29_V1_TA2-AC07_P43

**AC QUALITY REVIEW CHECKLIST (D29) FOR
AC7 – CONFINED DOUBLE ANNULAR JET
DELIVERED BY
VRIJE UNIVERSITEIT BRUSSEL**

Application Challenge (AC) Title: Confined Double Annular Jet
AC Author and Thematic Area: Ch. Hirsch, D.Vucinic/Vrije Unigversiteit Brussel, TA2-Combustion and Heat Transfer
Reviewer (Name/Organisation) : S.Drobniak, A. Boguslawski /Institute of Thermal Machinery, Technical University of Czestochowa

1	TOP LEVEL CHECK	YES	NO	CO
1	Is this AC an Industrial test case for judging CFD competency?	✓	<input type="checkbox"/>	✓
1	Are the design/assessment parameters (DOAPs) defined?	✓	<input type="checkbox"/>	<input type="checkbox"/>
1	Have these assessment parameters been measured?	✓	<input type="checkbox"/>	<input type="checkbox"/>
1	Are CFD calculations available ?	✓	<input type="checkbox"/>	<input type="checkbox"/>
1	Importance of AC to Industrial Sector (IS)?	H ✓	M <input type="checkbox"/>	L <input type="checkbox"/>

Comments: This is probably very difficult test case for judging CFD competency and RANS modeling because of some large-scale structures present in the flowfield. There are some interesting experimental and theoretical works published recently on double and single annular jets with swirl which is expected to promote the jet instability. Swirling imposed on the annular jets could be considered as the next step in testing CFD competency in this important industrial test case

Please identify Underlying Flow Regimes for this AC:
Annular jet

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DETAILED CHECK

2	GEOMETRY	YES	NO	CO
2.1	Is the geometry fully specified?	✓	<input type="checkbox"/>	<input type="checkbox"/>
2.2	Are the locations of boundaries specified?	✓	<input type="checkbox"/>	<input type="checkbox"/>
2.3	Are the boundary types specified?	✓	<input type="checkbox"/>	<input type="checkbox"/>
2.4	Is the geometry clearly illustrated?	✓	<input type="checkbox"/>	<input type="checkbox"/>
2.5	Is the geometry available in digital form?	✓	<input type="checkbox"/>	<input type="checkbox"/>

Comments:

3	FLOW PHYSICS AND FLUID DYNAMICS DATA	YES	NO	CO
3.1	Are the physics of key processes identified?	✓	<input type="checkbox"/>	✓
3.2	Are the properties of the fluid specified?	✓	<input type="checkbox"/>	✓
3.3	Are the governing non-dimensional parameters (GNDPs) identified?	✓	<input type="checkbox"/>	✓

Comments:

- 3.1. It is assumed that the flow is fully turbulent and only mean values and statistical moments are measured. However, it seems to be very likely, from the instantaneous velocity fields shown in Fig. 7, that the flow is dominated by large-scale unsteady phenomena. For understanding the flow physics some frequency characteristics of the velocity oscillations should be registered. The need to use TRANS or LES should at least be discussed
- 3.2. Location of exit and entrance to determine pressure drop is not clear
- 3.3. If unsteady behavior of the flow were taken into consideration Strouhal number should be introduced as another GNDP

TEST DATA

4	OVERVIEW OF TEST DATA	YES	NO	CO
4.1	Have all the experiments been adequately defined?	✓	<input type="checkbox"/>	<input type="checkbox"/>
4.2	Are the measurement techniques used described?	✓	<input type="checkbox"/>	<input type="checkbox"/>
4.3	Has a summary of test runs been provided (matrix)?	✓	<input type="checkbox"/>	✓
4.4	Are there any important scaling issues/simplifications/uncertainties associated with the test geometry?	<input type="checkbox"/>	✓	<input type="checkbox"/>
4.5	Impact of uncertainties on DOAPs ?	<input type="checkbox"/>	✓	<input type="checkbox"/>
		H	M	L
Comments:				
4.3. The summary matrix is not exactly in the form proposed in the template for final application challenge documentation, but it is clear what parameters were measured				

5	EXP1	YES	NO	CO
5.1	Is the experimental setup defined unambiguously?	✓	<input type="checkbox"/>	<input type="checkbox"/>
5.2	Are the geometrical parameters defined?	✓	<input type="checkbox"/>	<input type="checkbox"/>
5.3	Are the values of GNDPs specified?	✓	<input type="checkbox"/>	<input type="checkbox"/>
5.4	Are the measured parameters (MPs) fully described?	✓	<input type="checkbox"/>	<input type="checkbox"/>
5.5	Are measured data available in digital format?	✓	<input type="checkbox"/>	<input type="checkbox"/>
5.6	Have conditions at all boundaries been specified?	✓	<input type="checkbox"/>	<input type="checkbox"/>
5.7	Are any of the boundary data uncertain?	<input type="checkbox"/>	✓	<input type="checkbox"/>
5.8	Is a realistic estimate of data accuracy given?	<input type="checkbox"/>	✓	✓
		H	M	L

5. 9	Impact of uncertainties on DOAPs ?	✓	<input type="checkbox"/>	<input type="checkbox"/>
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Comments:

5.8. It is surprising that the error of mean velocity measurements is lower than the error for turbulent stresses and that the shear stresses were measured more accurately than normal ones. According to our experience the error of shear stress measurements is 3 to 4 times higher than for normal ones. We would expect the accuracy of 5% as more realistic for shear stresses.

6	EXP2	YES	NO	CO
6.1	Is the experimental setup defined unambiguously?	✓	<input type="checkbox"/>	<input type="checkbox"/>
6.2	Are the geometrical parameters defined?	✓	<input type="checkbox"/>	<input type="checkbox"/>
6.3	Are the values of GNDPs specified?	✓	<input type="checkbox"/>	<input type="checkbox"/>
6.4	Are the measured parameters (MPs) fully described?	✓	<input type="checkbox"/>	<input type="checkbox"/>
6.5	Are measured data available in digital format?	✓	<input type="checkbox"/>	<input type="checkbox"/>
6.6	Have conditions at all boundaries been specified?	✓	<input type="checkbox"/>	<input type="checkbox"/>
6.7	Are any of the boundary data uncertain?	<input type="checkbox"/>	✓	<input type="checkbox"/>
6.8	Is a realistic estimate of data accuracy given?	<input type="checkbox"/>	✓	✓
		H	M	L
6.9	Impact of uncertainties on DOAPs ?	✓	<input type="checkbox"/>	<input type="checkbox"/>

Comments:
6.8. Error for mean value is realistic but for rms and Reynolds stresses still underestimated

CFD SIMULATIONS

7	OVERVIEW OF CFD SIMULATIONS	YES	NO	CO
7.1	Have all the CFD runs been adequately defined?	✓	<input type="checkbox"/>	<input type="checkbox"/>
7.2	Are the solution techniques used described?	✓	<input type="checkbox"/>	✓
7.3	Has a summary of runs been provided (matrix)?	<input type="checkbox"/>	✓	<input type="checkbox"/>
7.4	Are there any important uncertainties associated with the computational domain geometry?	<input type="checkbox"/>	✓	<input type="checkbox"/>
		H	M	L
7.6	Impact of uncertainties on DOAPs ?	<input type="checkbox"/>	✓	<input type="checkbox"/>

Comments:
7.2 Not very detailed

8	CFD1 (<i>Copy and complete this section for each set of CFD data</i>)	YES	NO	CO
8.1	Is the modelling strategy defined?	✓	<input type="checkbox"/>	<input type="checkbox"/>
8.2	Is the modelling strategy appropriate for the physical problem?	✓	<input type="checkbox"/>	<input type="checkbox"/>
	Solution strategy			
8.3	Is the code (and version) specified?		✓	✓
8.4	Are the equations solved described adequately?	<input type="checkbox"/>	✓	✓
8.5	Is the numerical discretisation scheme used specified?	✓	<input type="checkbox"/>	<input type="checkbox"/>
8.6	Is the solution algorithm described?	✓	<input type="checkbox"/>	<input type="checkbox"/>
	Computational Domain			
8.7	Is the domain fully described?	✓	<input type="checkbox"/>	<input type="checkbox"/>
8.8	Boundary conditions fully detailed?	<input type="checkbox"/>	✓	✓
8.9	Is the domain used an idealisation/simplification?	✓	<input type="checkbox"/>	<input type="checkbox"/>
8.10	Is the mesh used fully described?	✓	<input type="checkbox"/>	<input type="checkbox"/>
8.11	Is the mesh quality appropriate?	✓	<input type="checkbox"/>	<input type="checkbox"/>
	Boundary Conditions			
8.12	Are the boundary conditions fully defined?	<input type="checkbox"/>	✓	✓
8.13	Are they appropriate?	<input type="checkbox"/>	<input type="checkbox"/>	✓
8.14	Do these replicate conditions in test rig?	<input type="checkbox"/>	<input type="checkbox"/>	✓
8.15	Were sensitivity runs carried out to explore effects of uncertainties in boundary data?	<input type="checkbox"/>	✓	<input type="checkbox"/>

8.16	Application of physical models Were turbulence models and other physical models applied in an appropriate and consistent way?	✓	<input type="checkbox"/>	<input type="checkbox"/>
8.17	Numerical Accuracy Is there any demonstration/estimation of numerical (discretisation) accuracy?	✓	<input type="checkbox"/>	<input type="checkbox"/>
8.18	Was a mesh sensitivity study carried out?	✓	<input type="checkbox"/>	<input type="checkbox"/>
8.19	Was sufficient iteration convergence achieved?	✓	<input type="checkbox"/>	<input type="checkbox"/>
8.20	Impact of uncertainties on DOAPs ?	H <input type="checkbox"/>	M ✓	L <input type="checkbox"/>

Comments:

8.3 Probably a NUMECA code
8.4 Not described – just mentioned
8.8/12/13 Boundary conditions at walls and outlet not given. At inlet turbulent viscosity set equal to molecular viscosity without justification

9	EVALUATION - Comparison of Test data and CFD	YES	NO	CO
8.1	Is the comparison of CFD and test data clearly presented?	✓	<input type="checkbox"/>	✓
8.2	Are the discussion, conclusions and recommendations adequately supported by the available experimental and CFD results?	✓	<input type="checkbox"/>	✓

Comments:

More comparison and evaluation in a VUB report to which a link is provided

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