

ERCOFTAC SIG15 TEST CASE

ベンチマーク進捗報告

http://www.ercoftac.org/fileadmin/user_upload/bigfiles/sig15/database/index.html

北風 慎吾

ERCOFTAC(European Research Community of Flow, Turbulence and Combustion)

・・・テーマごとにグループ分けされていて、研究活動が行われている(燃焼・混相・粒子法etc)。その中の乱流モデリングのグループ(SIG15)が過去に開催したworkshopにおいて実施されたベンチマークのデータベースがある(この他にマンチェスター大が管理するClassic版も→富原さん@関西)

Special Interest Groups

Special Interest Groups

- Large Eddy Simulation
- Turbulence in Compressible Flows
- Environmental CFD
- Transition Modelling
- Dispersed Turbulent Two Phase Flow
- Stably Stratified and Rotating Turbulence
- Turbulence Modelling
- Drag Reduction and Flow Control
- Variable Density Turbulent Flows
- Particle Image Velocimetry
- Reactive Flows
- Transition Mechanisms, Prediction and Control
- Design Optimization
- Multipoint Turbulence Structure and Modelling
- Swirling Flows
- Bio-Fluid Mechanics and Heat Transfer
- Microfluidics and Micro Heat Transfer
- Aeroacoustics
- Smoothed Particle Hydrodynamics (SPH)
- Fluid Structure Interaction
- Synthetic Models in Turbulence
- Flame Suspension Flows

Special Interest Groups (SIG)

ERCOFTAC Special Interest Groups form the second pillar of the Association. SIG are composed of ERCOFTAC members working together on a well defined specific topic on Flow, Turbulence and Combustion.

Activities of Special Interest Groups are organizing Workshops, Comparison of Codes, Exchange of Research Results, Creation of Experimental and/or Material Data Bases, Organization of Courses, ...

ERCOFTAC Special Interest Groups are associated with at least two [Peer Journals](#), and have an international organizing committee.

SIGs are active on the following topics:

- SIG 1: Large Eddy Simulation
- SIG 4: Turbulence in Compressible Flows
- SIG 5: Environmental CFD
- SIG 10: Transition Modelling
- SIG 12: Dispersed Turbulent Two Phase Flow
- SIG 13: Stably Stratified and Rotating Turbulence
- SIG 15: Turbulence Modelling**
- SIG 16: Drag Reduction and Flow Control
- SIG 24: Variable Density Turbulent Flows
- SIG 28: Reactive Flows
- SIG 32: Particle Image Velocimetry
- SIG 33: Transition Mechanisms, Prediction and Control
- SIG 34: Design Optimization
- SIG 35: Multipoint Turbulence Structure and Modelling
- SIG 36: Swirling Flows
- SIG 37: Bio-Fluid Mechanics and Heat Transfer
- SIG 38: Microfluidics and Micro Heat Transfer
- SIG 39: Aeroacoustics
- SIG 40: Smoothed Particle Hydrodynamics
- SIG 41: Fluid Structure Interaction
- SIG 42: Synthetic Models in Turbulence
- SIG 43: Flame Suspension Flows

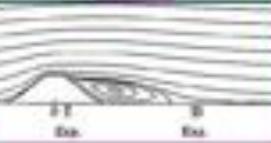
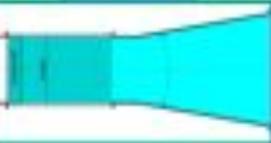
Missing numbers correspond to SIGs no longer believed to be active. All requests for

Latest Forum Posts

- ERCOFTAC's new web-site is now launched. SIG and PC...
October 2010
- Welcome to ERCOFTAC discussions. Please post here...
October 2010
- Welcome to ERCOFTAC discussions. Please post here...
October 2010
- Discussion group for Flame Suspension Flows...
17 December 2009
- Discussion group for Reactive Flows...
17 December 2009
- Discussion group for Drag Reduction and Flow Control...
17 December 2009
- Welcome to ERCOFTAC discussions. Please post here...
16 December 2009
- Welcome to ERCOFTAC discussions. Please post here...
14 December 2009
- ...
3 December 2009
- Discuss ERCOFTAC web-site issues...
1 October 2009

とりあえず、ケースファイル作りに精を出しており、検証はあまり進まず(赤線枠内が解析済み)
 以下は**4TH WORKSHOP**から**6TH WORKSHOP**まで、このぐらいまでは割と基礎的な流れがメイン
 青枠のケースは機能改良が必要だったり、境界条件がよくわかってなくて、不完全なものです

4th workshop at the University of Karlsruhe (3-7 April 1995)

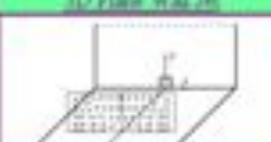
<p>4.1 Coaxial Flow with Free and Wavy Free Wall</p> 	<p>4.2 2D Model-Hill Flow (Saddle and anti-Hill)</p> 	<p>4.3 Steady Boundary Layer in a Conical Diffuser</p> 	<p>4.4 Wing Body Junction with Separation</p> 	<p>4.5 Developed Flow in a Curved Rectangular Duct</p> 
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5th workshop at EDF Chatou (25-26 April 1996)

<p>5.1 2D Free Wall Jet</p> 	<p>5.2 Natural Convection Boundary Layer</p> 	<p>5.3 Natural Convection in a Tall Cavity</p> 	<p>4.5 Developed Flow in a Curved Rectangular Duct</p> 
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ちなみに...
 CASE4.3はOpenfoamWikiの
 Turbomachineryグループが
 例題をHP上に用意しています

6th workshop at Delft University of Technology (6-7 June 1997)

<p>6.1 2D Free Wall Jet</p> 	<p>6.2 Fully Developed Flow and Heat Transfer in a Matrix of Surface-Mounted Cubes</p> 	<p>6.3 Flow around a Single Surface-Mounted Cubical Obstacle</p> 	<p>5.1 2D Free Wall Jet</p> 
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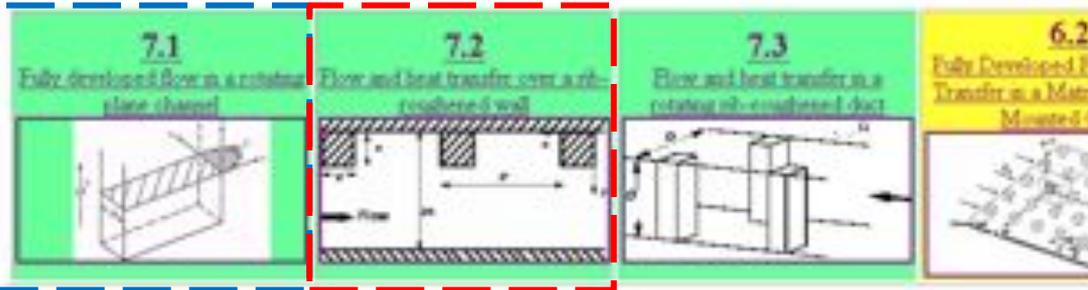
7th workshop at UMIST (28-29 May 1998)

徐々に流れが複雑になっていっています

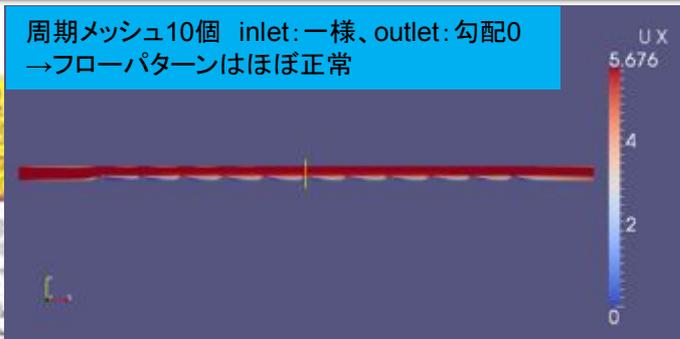
モデリングで困っているのは主流方向に周期境界条件を使うもの(ここでは**CASE7.2, 7.3, 9.2**など)

→掲示板で教えてもらいましたが、うまくいかず。発達した流れを作るのに周期構造をわざわざモデリング!

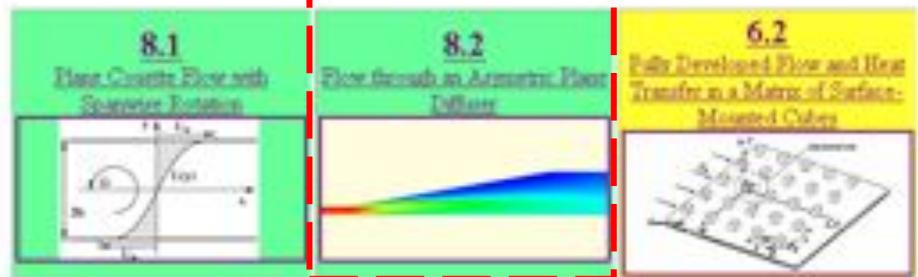
7th workshop at UMIST (28-29 May 1998)



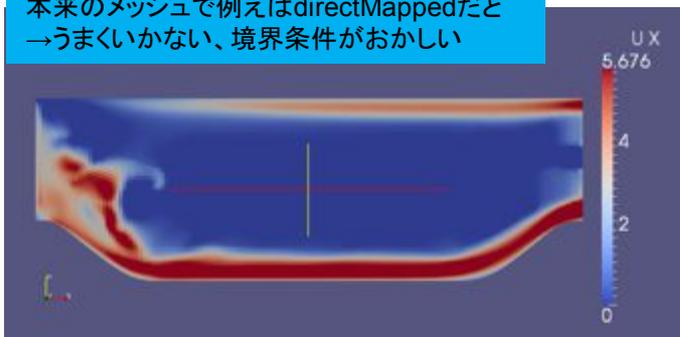
周期メッシュ10個 inlet: 一様、outlet: 勾配0
→フローパターンはほぼ正常



8th workshop at Helsinki University of Technology (17-18 June 1999)



本来のメッシュで例えばdirectMappedだと
→うまくいかない、境界条件がおかしい

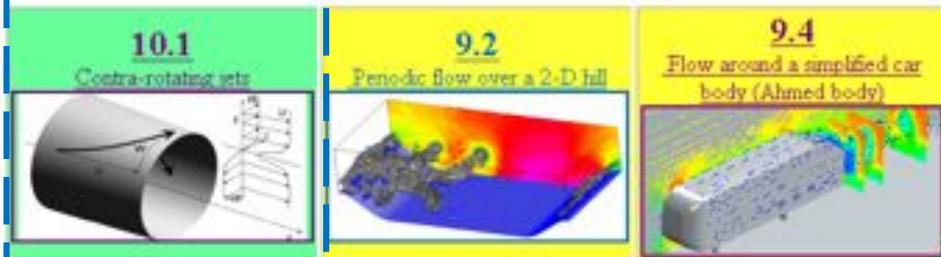


9th workshop at Darmstadt University of Technology (4-5 October 2001)



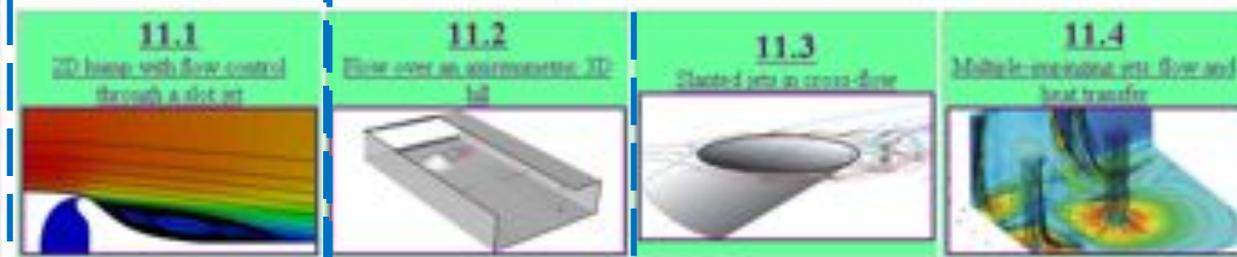
10th workshop at University of Poitiers (10-11 October 2002)

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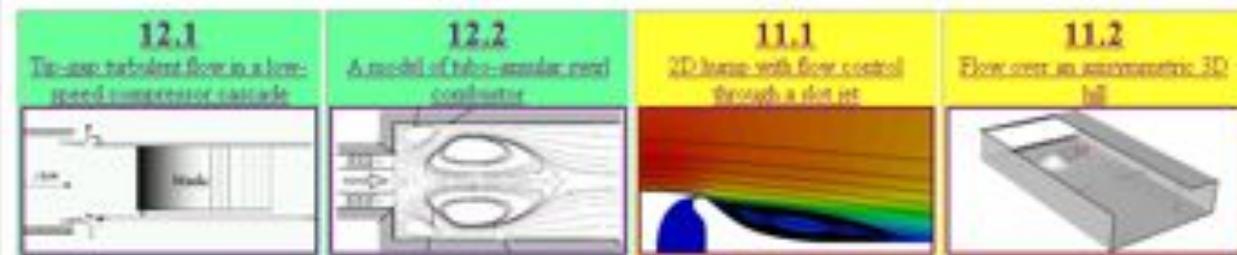


11TH以降はかなり実問題を対象にしているためか、**3次元問題**が中心手が回ってないせいもあって、ほとんどがモデリングすら未達の状態です...

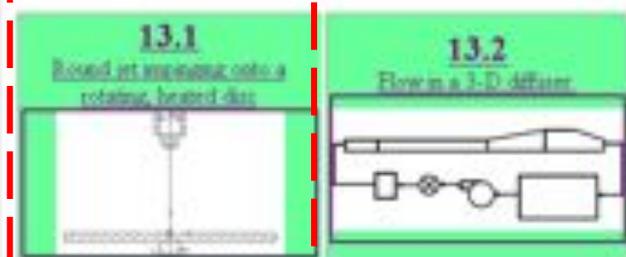
11th workshop at Chalmers University of Technology (7-8 April 2005)



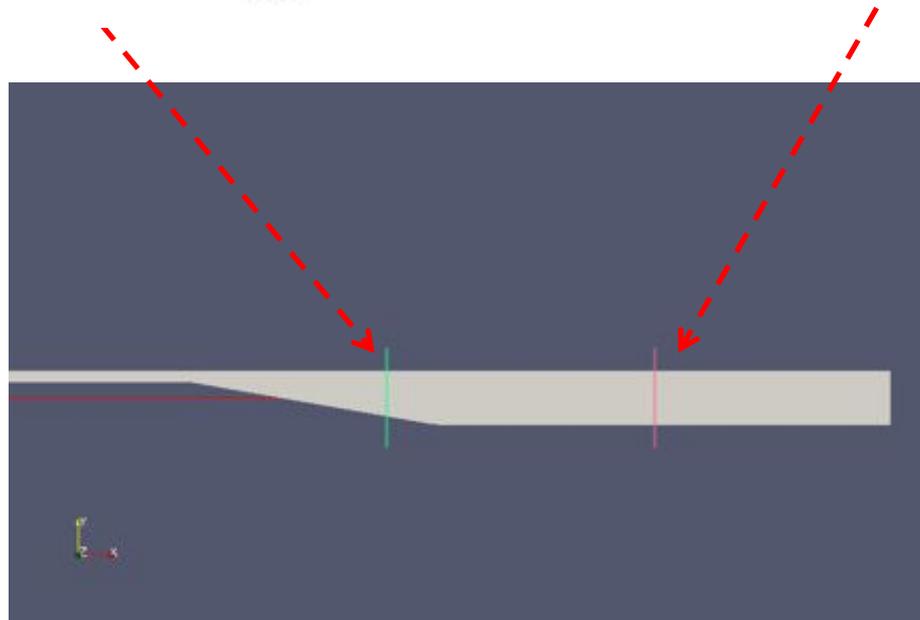
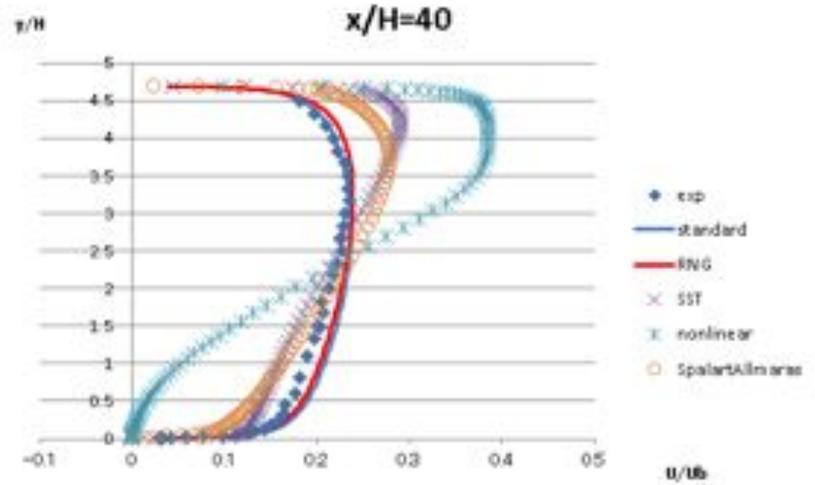
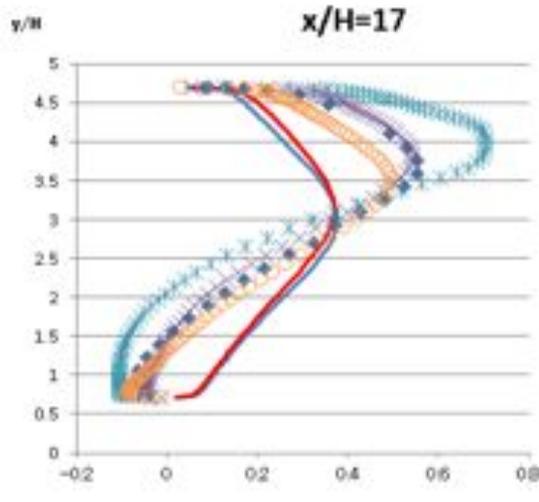
12th workshop at Technical University of Berlin (12-13 October 2006)



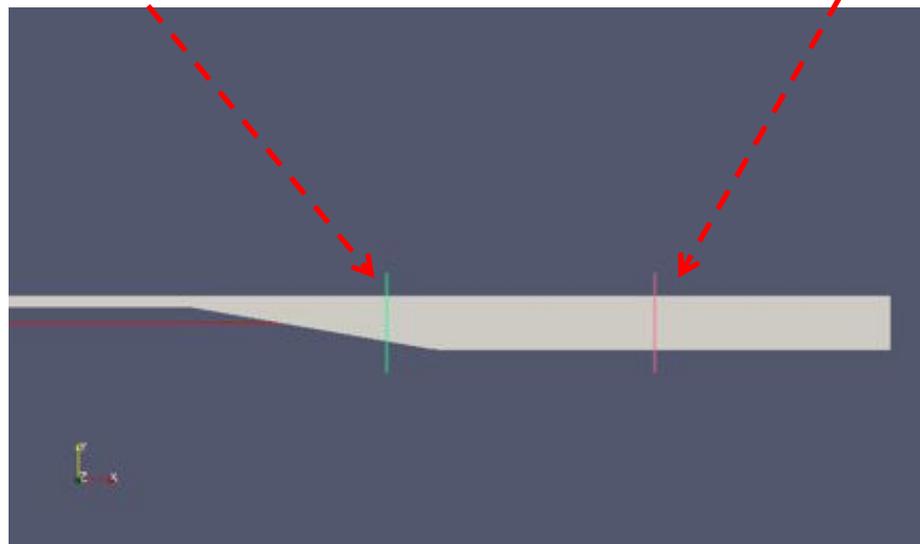
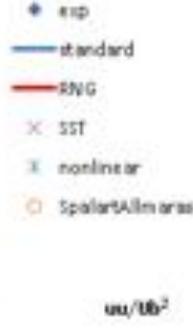
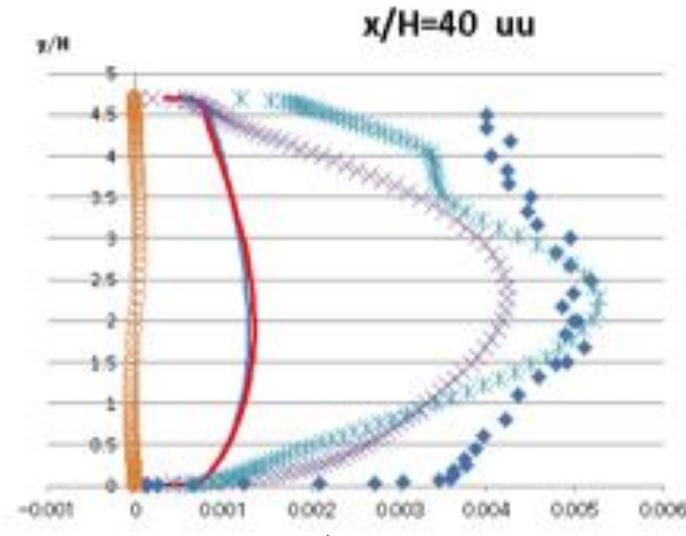
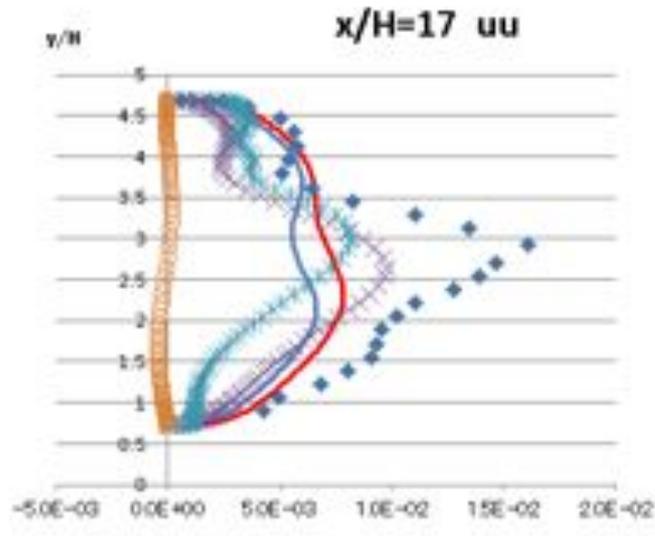
13th workshop at Graz University of Technology (25-26 September 2008)



流速分布:斜面上は**SST**、**SA**が良好 → 逆に後流では標準、**RNG**が良好(偶然?)
未収束(標準、**RNG**、**Shih**)、収束(**SST**、**SA**)した結果を比較するのに難がある...



Re応力分布:いずれも定量的には合わず、特徴的な**SA**の結果はモデルの特性?
 後流での流路中心位置のピークは**Shih**のみ近い値に → 非等方モデル故?



今後

1. Test caseを一通り揃えたい・・・

- ・後半の方は色々制約があって、モデリングにも難あり。3Dだと解析時間もかかる
- ・容量の制約がなければ、勉強会のwikiページに順次upしていきます
- ・「これ、私やりましょうか」というような参加してくれる方、募集中

2. 乱流モデル追加・改良

- ・コード改良という意味で最も手をつけやすい部分(だと個人的に思う)
- ・CFD-onlineにも幾つか置いてある(V2F, γ -Re- θ など、1.6-extで動作確認)
- ・日本語の文献が豊富(論文だけでなく、参考書レベルでも詳細に書いてある)

→手始めに低Re数モデルを作ってみた(Abe-Nagano-Kondohモデル)

ただし、 ε の壁面境界の厳密な与え方 $\varepsilon_{wall} = 2\nu(\partial\sqrt{k}/\partial y)^2$ が不明(groovyBC?)

3. 連成解析IFツールのインストールと、OFでの動作テスト

- ・国プロで流体-構造のカップリングツールを開発・提供
- ・開発している知り合い(というか、会社の同僚)によれば、コードがあれば、組込可能
- ・毎度のことながらインストールがうまくいってないので、そこをクリアするのが目標