CFD Research Group at Exeter – Ex-CFD

Dr Gavin Tabor

CEMPS

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Personal History

Dr Gavin Tabor

- PhD (1994) in Theoretical Astrophysics (Gas dynamics in Galaxies)
- Postdoc work in Engineering CFD : Prof David Gosman (Imperial College) 1994 – 1999
  - Variety of projects including multiphase flow, LES, FOAM
- Appointed to lectureship in Exeter – 1999
  - Research interests; turbulence modelling, code development (OpenFOAM), application in engineering, science + medicine

Group mission statement : to advance theory and application of CFD

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Exeter CFD group

Currently; 4 PhD students, 1 postdoc, 1 postgrad, 1 summer student :

- Bjoern Fabritius – GA Optimisation of Turbulence Models
- Matt Berry, Dr Mulualem Gebreslassie, Miriam Garcia – Tidal Turbines project
- Shenan Grossberg – Adjoint Optimisation
- David Tranter – blood flow in heart, Circle of Willis
- Heather Bolt – Neural Network modelling of pressure drop across an idealised stenosed artery

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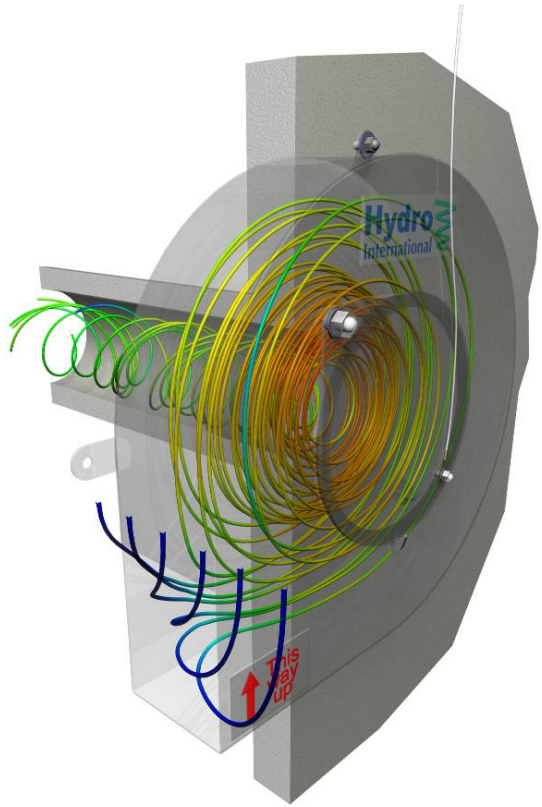
Previous projects

- Inlet conditions for LES (Dr Mohammad Baba-Ahmadi)
- Development of $k - \sqrt{\omega}$ turbulence model (visiting student Lijun Jiang)
- Simulation of VFC (Dr Daniel Jarman),
- Flow through packed beds (Dr Matt Baker) and foams (visiting student Augusto Della Torre)



Also : a range of student projects in CFD

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Group facilities

- CFD Workroom inc. 4 workstations (top spec; dual processor, 96GB RAM)
- Callisto beowulf cluster; 64 cores, 256 GB RAM
- Access to
  - Micro-CT scanner - 3 micron resolution
  - Advanced ALM manufacturing facilities
  - 3d visualisation
  - Zen supercomputer
- Codes; OpenFOAM, Fluent, ANSYS Workbench
- Meshing; Pointwise, ScanIP, ANSYS Workbench, snappyHexMesh

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National/International links

- Exeter : biofuels (Dr John Love), tidal turbines (Prof Mike Belmont), biomedical (Prof Philippe Young/Prof Peter Winlove), CWS
- Politecnico di Milano : IC Engines group (Prof Onorati)
- Virginia Tech : CFD research group (Prof Eric Paterson)
- U.Belgrade : CFD research group (Prof Hrvoje Jasak)

Extensively involved in global OpenFOAM community – member of OpenFOAM Workshop committee. Also on local organising committee ACME 2014 conference (Exeter).

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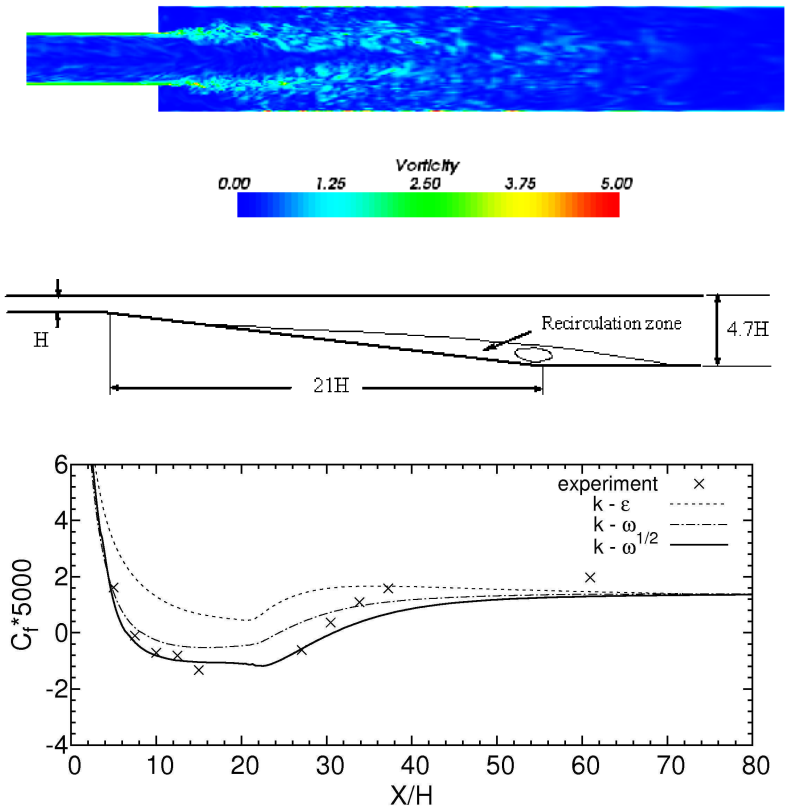
Turbulence modelling

Significant research interest over 15 years :

- LES – SGS modelling + inlet conditions
- Development of new turbulence models – eg. $k\sqrt{\omega}$
- New approaches to turbulence models – GA optimisation



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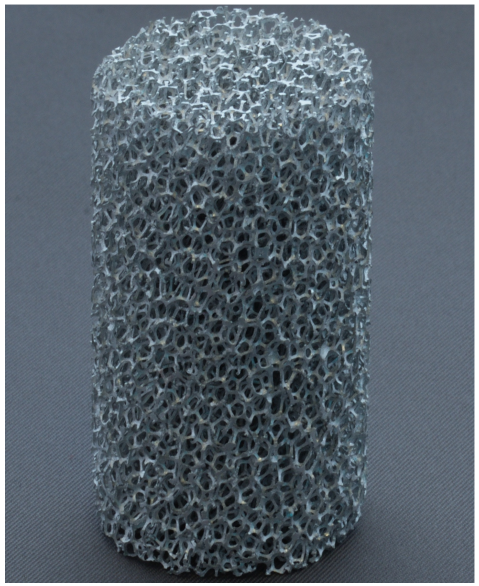
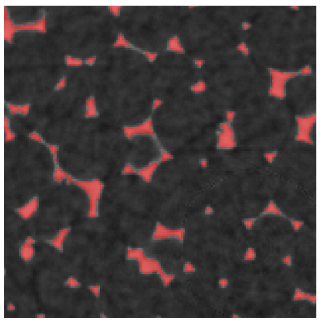
Porous media

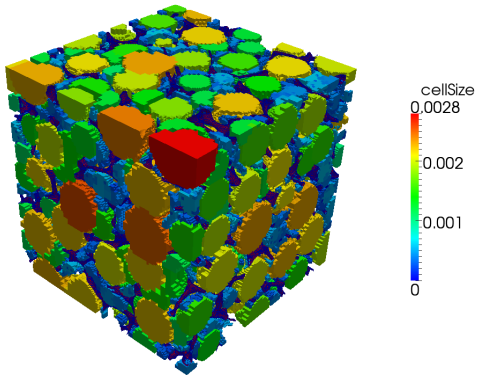
Geometry/mesh construction for complex domains – foams, packed beds

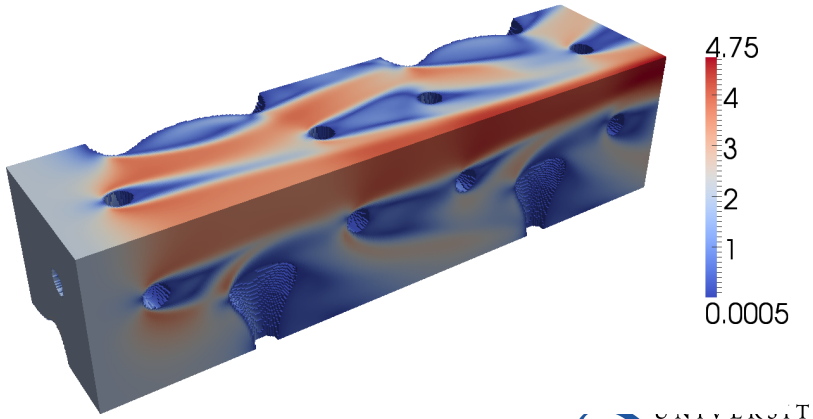
Imaged-Based Meshing tools (ScanIP, snappyHexMesh)

Applications for chemical process, catalysis, IC engines etc.









Sustainable Urban Drainage (SUDs)

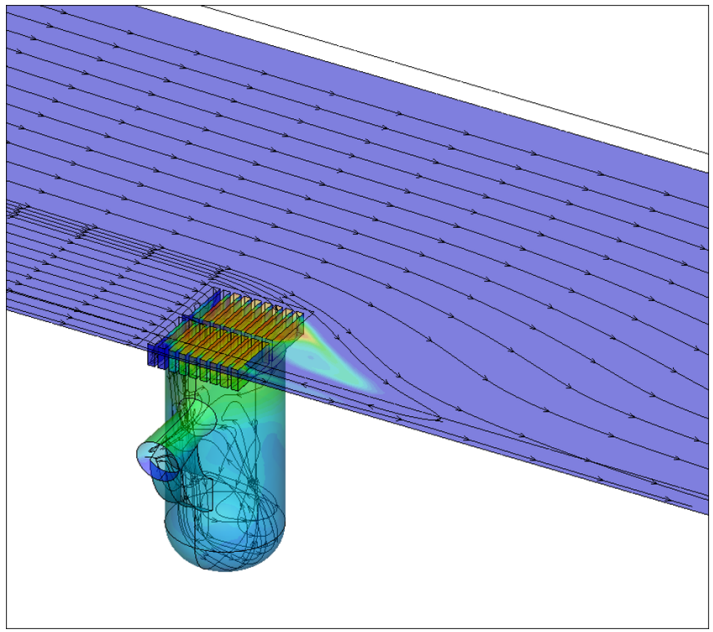
Collaborative work with members of CWS :

FRMRC-II project

- Runoff of surface water

Collaborative work with Hydro International :

- KTP on simulation of VFC Hydrobrake (Dan Jarman)
- Two 4th year group projects on VFC, Hydrofilterra units
- Current STREAM Eng.D. on Adjoint Optimisation



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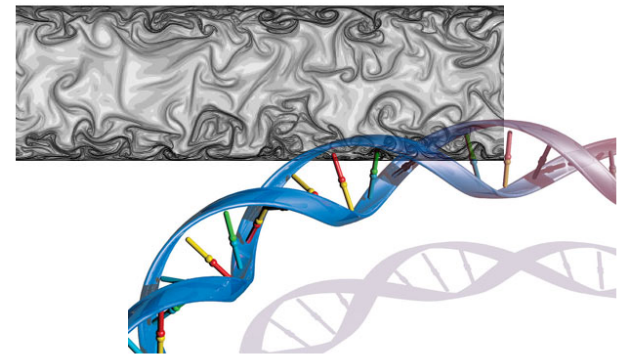
Other aspects of CFD

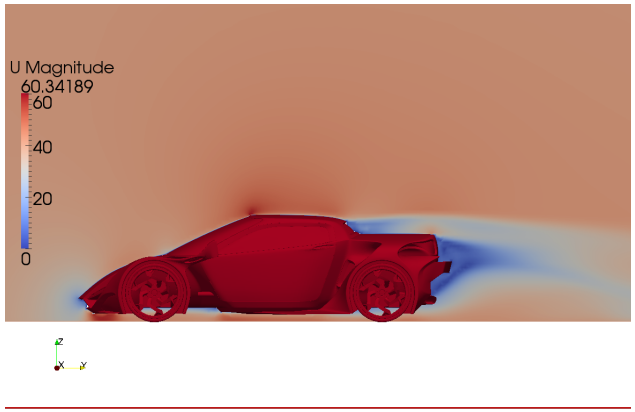
Optimisation :

- STREAM Eng.D on Adjoint Optimisation
- Developing interests in surrogate modelling, GA optimisation

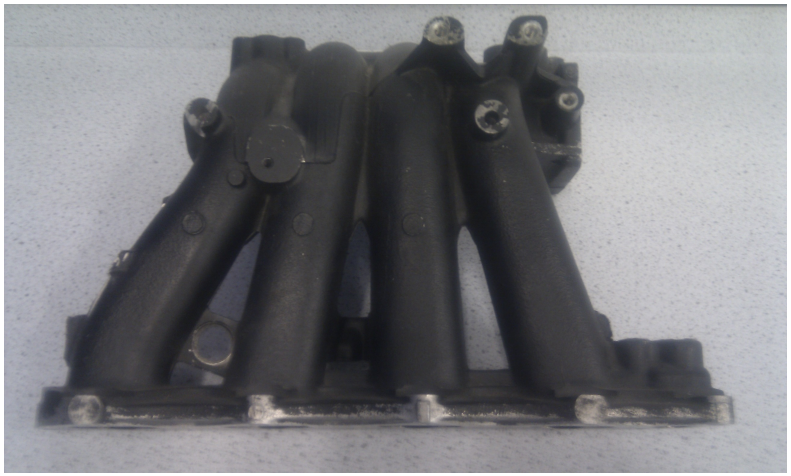
Industrial problems :

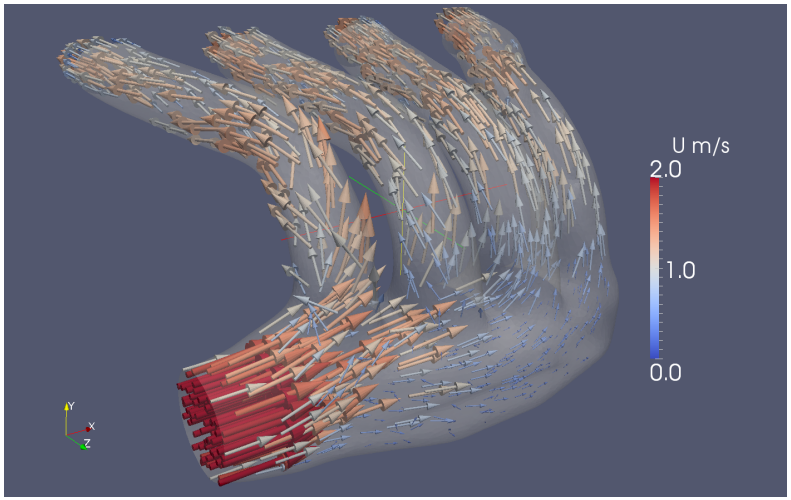
- Reverse engineering through IBM
- CAD import/GA optimisation of meshes





Other aspects of CFD (cont)





Biomedical

- Respiratory, cardovascular simulations
- Current project on FFR simulation
- Worked with Simpleware on IBM – medical and engineering applications

Code design (OpenFOAM)

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Collaboration

Support Rhys with OpenFOAM/Fluent, CFD. Beyond this there are a number of possible areas for collaboration : optimisation, microstructural flow + heat transfer

Mechanisms include

- 3rd year individual projects
- "...with Industrial Placement" projects
- 4th year group projects
- other industrial collaboration

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Possible areas of interest?

Turbulence simulation – LES, DES, inlet conditions

Design optimisation – GA, surrogates

Engineering application of CFD – CAD integration, mesh development, reverse engineering.

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