

Computational Fluid Dynamics Research at the University of Exeter

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Research – GRT

CFD research in a number of areas :

- Basics of CFD – turbulence modelling (RANS/LES), code development (OpenFOAM)
- Applications of CFD
 - Engineering applications – Urban Water Drainage, renewable energy, microstructural flow (porous media)
 - Biomedical applications – blood flow, air flow, Image Based Meshing
 - Optimisation – Adjoint Optimisation, GA/GP, surrogate modelling

Group structure

3 PhD students (1st supervisor) :

- Bjoern Fabritius (Application of GA optimisation to turbulence models)
- Matt Berry (Modelling of MRL tidal turbine)
- Shenan Grossberg (Application of Adjoint Optimisation to Urban Drainage Modelling)

... 2nd supervisor to 4 CFD-related projects.

Past students : 7 PhD, 3 visiting PhD students, 3 postdoctoral – projects in tidal energy, SUDS, flow in porous media, RANS turbulence modelling, biofluids.

Group experience in

- OpenFOAM
- Fluent
- Pointwise
- ScanIP

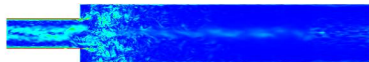
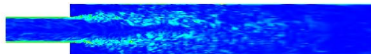
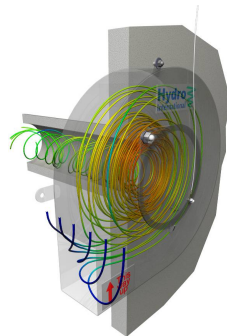
Facilities : network of Linux workstations, 18 node Beowulf cluster (Neptune); access to μ -CT scanning, 3d visualisation, ALM facilities.

Work funded by EPSRC, DTI, Laing Foundation, STREAM doctoral centre.

Turbulence modelling

LES : Model development, Inlet conditions

RANS : Model development, optimisation, application in SUDS + elsewhere



Sustainable Urban Drainage

Member of Exeter's Centre for Water Systems (CWS) – international group with interests in optimisation, modelling, SUDS etc.

Extensive interaction – eg. with FRMRC-II project (runoff from roads);

Also industrial – Hydro International (projects on Vortex Flow Control, filtration, Adjoint Optimisation).

SUDS

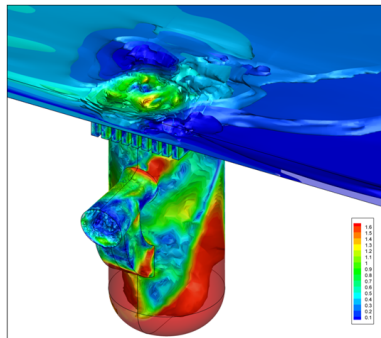
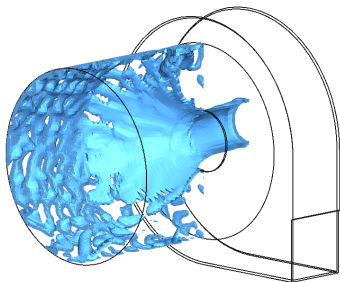


Image-Based Meshing

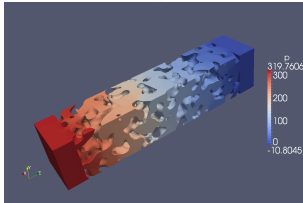
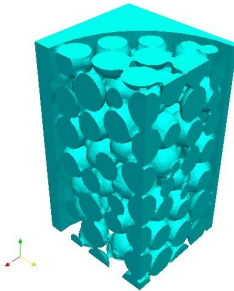
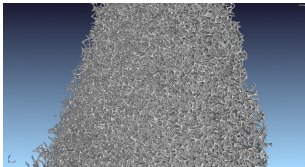
Meshing always critical step in successful CFD

Biomedical CFD – further complications:

- Difficulty of determining actual geometry
- Patient-specific variability

Extensive work on Image-Based Meshing (collaboration with Simpleware Ltd) – applied to biomedical research (heart flow, Circle of Willis) and other areas (reverse engineering, microstructural flow).

Microstructural Flow



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