

## David Frederick Fletcher: Curriculum Vitae and Publication List

**Adjunct Professor**

**School of Chemical and Biomolecular Engineering,  
University of Sydney, NSW 2006, Australia**

**Tel: +61 2 9351 4147**

**Fax: +61 2 9351 2854**

**e-mail: [d.fletcher@usyd.edu.au](mailto:d.fletcher@usyd.edu.au)**



### Qualifications

- Habilitation à Diriger des Recherches (HDR), Institut National Polytechnique de Toulouse, France, 2002.
- PhD in Mathematics, University of Exeter, UK, 1982. Thesis title: The calculation of heat or mass transfer in separated flows.
- BSc (Hons) First Class in Mathematics, University of Exeter, UK, 1979. (Awarded the University Prize for Mathematics.)

### Work Experience

After completing my PhD studies, I worked for ten years as a research scientist at the United Kingdom Atomic Energy Authority, where I performed research on multiphase explosions and fire safety. I contributed work to the enquiry into the Chernobyl reactor accident and towards the licensing of the Sizewell B Pressurised Water Reactor (PWR). I also carried out a variety of industrial projects using Computational Fluid Dynamics. When I left the UK to migrate to Australia I was a section leader with responsibility for five staff.

Since 1993 I have been associated with the University of Sydney in various research capacities, where I am currently an Adjunct Professor in the School of Chemical and Biomolecular Engineering. I am also a Visiting Professor at the Institut National Polytechnique de Toulouse and I was a CNRS visiting fellow in 2004 and 2007. I am active in research, being an investigator on ARC discovery and industry linkage grants. I am supervisor or co-supervisor of on average six PhD students. I have strong ties with the Mixing and Agitation Group at the Institut National Polytechnique de Toulouse and the Membrane group at the Université Paul Sabatier, Toulouse. I have now graduated 21 PhD students as either the supervisor or as a co-supervisor where I made a significant contribution to the thesis project. This number includes two cotutelle students who carried out their doctoral studies partly in France and partly in Australia.

I derive my income from running my own CFD research and consultancy business as a sole trader, working for a variety of university and industrial clients, as well as being the senior CFD specialist for the local ANSYS software distributor, LEAP Australia.

## Technical Expertise

I have thirty years experience in the field of Computational Fluid Dynamics (CFD), where I have been involved in a wide range of activities ranging from algorithm development to simulation of complex industrial flows. I have worked on an exceptionally wide range of applications due to my involvement with the ANSYS CFX distributors. In addition to this I have significant experience of multiphase, reacting flows and combustion arising from my research work at the UK Atomic Energy Authority and at the University of Sydney. In summary:

- I have studied and worked in the field of applied mathematics and computational physics, applied to the areas of fluid dynamics, heat transfer and mass transfer. I have written my own CFD codes to study single and multiphase flows, and to investigate multiphase explosions.
- I have considerable knowledge and experience of industrial Computational Fluid Dynamics (CFD) based around the ANSYS CFX and FLUENT software packages. I have strong links with the software developers and contribute significantly to software testing and design.
- I have performed major CFD-based research and/or development projects, including modelling of a rotary swirl cyclone used for SO<sub>2</sub> scrubbing, a biomass gasification plant, multiphase mixing of slurries and particle jets, particle classifiers, extrusion of multi-component pastes, gaseous combustors, spray dryers, calciners, design studies of cyclones, gas dispersion and plume modelling, coupled chemistry problems, mechanically agitated vessels, micro-mixers and micro-structured heat transfer devices, membrane systems, biomedical flows, pharmaceutical dry powder inhalers, flows in rotating machinery, supersonic particle laden gas flows, oil-fired and gas-fired furnaces.
- I have performed CFD modelling of fires, fire extinguishment and smoke movement in multi-compartment buildings, tunnels and on offshore platforms. This work also involved design of experiments, data analysis and integration of results from CFD studies into risk assessments.
- I spent twelve years studying the physics and modelling of steam explosions (often called vapour explosions or Rapid Phase Transitions) involving the explosive transfer of heat from a hot liquid to a cold volatile liquid. I have acted as a consultant to Nuclear Electric, USNRC, CEA, Ontario Hydro, various metal companies and provided advice to the UK Health and Safety Executive in the area of steam explosions. For this work I developed my own multiphase flow computer codes to simulate fluid mixing and shock wave propagation in multiphase mixtures.
- I have considerable knowledge of phase change heat transfer arising from my nuclear experience, which I have applied to boiling and condensation in micro-channels, micro-scale two phase flows, film boiling droplets and nuclear safety applications.

## Languages

- French as a hobby for 25 years, in which I routinely give seminars, examine theses and have written several book chapters.
- Italian as a hobby for 15 years.

## Published Journal Articles and Book Chapters

I publish widely in the area of CFD research and its application to mineral and chemical processes, micro-technology and biomedical/pharmaceutical applications. These publications have been cited 1488 and 1327 times and I have h-indices of 21 and 20 in the Scopus and ISI databases, respectively.

[175] L.E. Bilston, M.A. Stoodley and D.F. Fletcher, *Relative timing of arterial and sub-arachnoid space pulse waves influences spinal perivascular CSF flow - a possible factor in syrinx development?* Accepted for publication in *Journal of Neurosurgery*.

[174] D.F. Fletcher and T.A.G. Langrish, *Scale-adaptive simulation (SAS) modelling of a pilot-scale spray dryer*. Accepted for publication in *Chemical Engineering Research and Design*.

[173] D.F. Fletcher, P.E. Geyer and B.S. Haynes, *Assessment of the SST and omega-based Reynolds stress models for the prediction of flow and heat transfer in a square-section U-bend*. Accepted for publication in *Computational Thermal Sciences*.

[172] J.-P. Torré, P. Higgins, C. Xuereb and D.F. Fletcher, *A novel method to include the free surface in a CFD model of jet injection into partially-baffled mixing vessels*. Accepted for publication in *Progress in Computational Fluid Dynamics*.

[171] M.S. Mason, G.S. Wood and D.F. Fletcher, *Influence of tilt and surface roughness on the outflow wind field of an impinging jet*. ***Wind & Structures***, 13(3), 179-204, (2009).

[170] R. Gupta, D.F. Fletcher and B.S. Haynes, *On the CFD modelling of Taylor flow in microchannels*. ***Chem. Eng. Sci.***, 64(12), 2941-2950, (2009).

[169] C.K.W. Cheung, D.F. Fletcher and G.W. Barton, *Impact of chlorine dissociation for modified chemical vapor deposition*. ***J. Non-Cryst. Solids***, 355(13), 817-820, (2009).

[168] D.F. Fletcher and G.J. Brown, *Numerical simulation of solid suspension via mechanical agitation: effect of the modelling approach, turbulence model and hindered settling drag law*. ***Int. J. Comput. Fluid Dynam.***, 23(2), 173-187, (2009).

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[165] M.S. Coates, P. Tang, H.-K. Chan, D.F. Fletcher and J.A. Raper, *Characterization of pharmaceutical aerosols and dry powder inhalers for pulmonary drug delivery*. In *Particulate Systems in Nano- and Biotechnologies*, (Eds. W. Sigmund, H. El-Shall, B. Moudgil and D. Shah), Chapter 9, 193-222, Taylor and Francis, (2008).

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- [162] J.J. Nijdam, T.A.G. Langrish and D.F. Fletcher, *Assessment of an Eulerian CFD model for prediction of dilute droplet dispersion in a turbulent jet*. **Appl. Math. Model.**, 32(12), 2686-2705, (2008).
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