Paul Bartholomew

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I am a research assistant at Imperial College London, currently working on the eCSE project 'A high-order accurate solver for free-surface flows' and previously completed a PhD at Imperial College London, working on the development of a fully-coupled solver for the two-fluid model of multiphase flows. In the course of my research, I have implemented a variable-density solver for Incompact3D as part of a previous eCSE project, and am continuing this work to develop free-surface capabilities for the Incompact3D software; during my PhD I developed pressure-velocity implicit and pressure-velocity-volume fraction implicit solvers for the two-fluid model on collocated, unstructured meshes in MultiFlow. Additionally, my research interests have covered Momentum Weighted Interpolation and its application to multiphase flows, particularly the theoretical basis for, and justification of, its use. I have a broad experience of working with parallel, general purpose CFD codes developed in-house and have contributed to their development in a range of areas including: IO, automated meshing and investigating preconditioners in addition to the implementation of the aforementioned solvers.

Education

2013 – 2017 **PhD in Computational Fluid Dynamics**, *Imperial College London*.
Supervisors: B. van Wachem (Imperial College), A. Marquis (Imperial College).

2009 – 2013 **MEng. (First class) in Mechanical Engineering**, *Imperial College London*.

2007 – 2008 **Advanced Highers**, *AAA in Chemistry, Maths and Physics*.

2006 – 2007 **Highers**, *AAAA in Chemistry, Maths, Physics and Technical Studies; B in English*.

2004 – 2006 **Standard Grades**, *Grade 1 in Art, Chemistry, French, Geography, Maths, Physics and Technical Studies; grade 2 in English*.

Academic Prizes,
3rd year Dean's list, Mechanical Engineering
Senior Proxime Accessit, Bearsden Academy.

Professional/research experience

2018 – 2019 **eCSE 13-03 *A high-order accurate solver for free-surface flows***, Imperial College London.
Supervisor: S. Laizet, Imperial College London
Since October 2018 I have been working on developing a free-surface simulation capability in Incompact3D, building upon the variable density solver developed for *eCSE 10-02*. This has entailed implementing high-order interface capturing (`WENO`) schemes for Incompact3D. During this project we have as a group undertaken a significant rewrite of the Incompact3D software to produce Xcompact3D with the intention of modernising the code base and making it easier to use for non group members. This work has lead to the preparation of a new paper to be submitted for peer-review in the near future.

2017 – 2018 **eCSE 10-02 *An adjoint solver for variable-density flows in the low Mach number limit***, Imperial College London.
Supervisor: S. Laizet, Imperial College London
This project was focused on the implementation of a Low Mach Number solver in the open-source CFD code Incompact3D, available at: `https://github.com/ptb0890/Quasincompact3d`. In the course of this project I have gained experience programming in Fortran and using Tier-0/Tier-1 super computers. I have presented results from the project at the Incompact3D User Group 2018 meeting at Imperial college and at the UK Fluids Conference 2018 at the University of Manchester. This work has lead to the publication of a peer-reviewed journal paper (*Bartholomew & Laizet 2019*).

2012 **Undergraduate Research Opportunities Programme**, Imperial College London.
Supervisor: A. Marquis, Imperial College London
I obtained funding to join a research group in the Thermofluids division of the Mechanical Engineering department at Imperial College for the summer between the third and final year of my undergraduate MEng. degree. During my project I looked at automating analysis with Paraview using the Python API and developed a CFD code based on the SIMPLE algorithm.

2008 – 2009 **Year In Industry**, *BAE Systems*, Glasgow.
Supervisor: A. McNally
Between finishing high school and starting university I spent a year working in the operations department at the BAE Systems shipyard in Scotstoun, Glasgow. During my time there I implemented a requisition tracking system to facilitate the transfer of materials between projects and assisted in project management of the Seagull barge refit for charity.

Publications

P. Bartholomew, S. Laizet, *A New Highly Scalable, High-Order Accurate Framework for Variable-Density Flows: Application to Non-Boussinesq Gravity Currents in Computer Physics Communications* , 2019.

P. Bartholomew, F. Denner, M. H. Abdol-Azis, A. Marquis, B. van Wachem, *Unified Formulation of the Momentum-Weighted Interpolation for Collocated Variable Arrangements in Journal of Computational Physics* , 2018.

Conference and seminar presentations

May 2019 **P. Bartholomew, G. Deskos, S. Laizet**, *Xcompact3d: A Powerful Framework to Study Turbulent Flows with Turbulence-Resolving Simulations*, EuroHPC, 13-17 May 2019, Poznań, Poland.

Apr 2019 **P. Bartholomew, S. Laizet**, *Modernising and expanding the capabilities of the high-order flow solver Incompact3d (Poster)*, Numerical Algorithms for High-Performance Computational Science, 8-9 February 2019, London, United-Kingdom.

Feb 2019 **P. Bartholomew, S. Laizet**, *Modernising and expanding the capabilities of the high-order flow solver Incompact3d (Poster)*, RSLondonSouthEast Workshop 2019, 7 February 2019, London, United-Kingdom.

Sep 2018 **P. Bartholomew, S. Laizet**, *QuasIncompact3D: A Highly Scaleable Solver for Navier Stokes in the Low Mach Number Limit*, UK Fluids Conference, 4-6 September 2018, Manchester, United-Kingdom.

Apr 2018 **P. Bartholomew, S. Laizet**, *Simulations of Variable-Density Flows in the Low Mach Number Limit*, Incompact3D User Group Meeting 2018, April 2018, London, United-Kingdom.

Sep 2016 **P. Bartholomew, A. Marquis, B. van Wachem**, *Modelling of Turbulent Gas-Solid Flows in the Eulerian Framework*, Inaugural UK Fluids Conference 2016, 7-9 September 2016, London, United-Kingdom.

May 2016 **P. Bartholomew, A. Marquis, F. Denner, B. van Wachem**, *Development of a Fully Coupled Solver for the Eulerian-Eulerian Approach*, 9th International Conference on Multiphase Flow (ICMF 2016), 22-27 May 2016, Florence, Italy.

Teaching activities

2015-2017 **CDT - Computational Fluid Dynamics**, *Teaching assistant*, Imperial College London.

Computer skills

Languages **C, Fortran, Python, LaTeX, Matlab**

Software **Linux, MPI, Paraview, PETSc**

Interests

Sports **Cycling, Badminton, Squash**

Hobbies **Guitar**

Referees

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