

Yang Wang

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Research Interests

- Energy (generation, storage, and utilization) system modelling and optimization
- Scientific computation, multi-physics modelling and optimisation
- Computational Fluid Dynamics in multi-disciplinary applications

Skills

- Numerical methods for Partial Differential Equations: algorithms, discretisation schemes and linear solvers
- Multi-scale and multi-physics modelling, numerical optimisation: stochastic and deterministic methods
- Finite Volume Method and Spectral Element Method (Finite Element Method + Spectral Method)
- Fortran, MATLAB/SIMULINK and C++ programming
- Tools/software: Aspen Plus, SolidWorks, ProE, GMSH, ICEM, ParaView, OpenFOAM, Fluent,
- Automatic Differentiation (AD) tool TAPENADE
- Linux operation systems, Shell script, Vim, Meld, Make, Git, Doxygen, Gprof, and HYPRE open source libraries
- MS Office tools (e.g. Word, Excel and PowerPoint), Texmaker (editor for Latex), etc.

Education

- 2012. 9 - 2017. 1 PhD in Mechanical Engineering, Queen Mary, University of London, United Kingdom
- 2009. 9 - 2012. 6 MSc in Power Engineering and Thermophysics, Xi'an Jiaotong University, China
- 2005. 9 - 2009. 7 BEng in Energy and Power Engineering, Xi'an Jiaotong University, China

Research Experience

- 2017. 11 - present Parenting and working from home during relocation, Cambridge, USA
 - Researching on multi-physics modelling and computation strategies
 - Machine Learning by Stanford University on Coursera
 - Writing and publishing journal papers; doing peer reviews for journals
- 2017. 3 - 2017. 10 Research fellow on projects funded by Engineering and Physical Science Research Council (EPSRC), School of Engineering, University of Warwick, Coventry, United Kingdom
 - *Next Generation Grid Scale Thermal Energy Storage Technologies:*
 - * Developed a MATLAB/SIMULINK tool for dynamic modelling thermal energy storage (sensible, phase-change, packed bed, and heat reservoir) for optimally designing heat storage systems;
 - * Using the developed model, various applications of energy storage were carried out, including optimal design of packed bed thermal energy storage, optimal design of radial turbine in CAES applications, system optimization of grid-scale CAES and TES applications, etc.
 - *Ultra-Supercritical (USC) steam power generation technology with Circulating Fluidized Bed (CFB): Combustion, Materials and Modelling:*
 - * Developed heat transfer numerical models of a CFB boiler integrated with water-wall heat exchange
- 2012. 9 - 2017. 1 PhD candidate, working on the project *About Flow* funded by the European commission
 - Developed in-house CFD codes (in Fortran) with discrete adjoint sensitivity/gradient solvers using Automatic Differentiation
 - Solver development on cell-centered/face-based and node-centered/edge-based data structure
 - SIMPLE-like algorithms vs. Pressure Schur Complement (PSC) method theoretical derivation

- Validated in-house CAD tool (NsPCC: NURBS-based parametrisation with continuity constraints) for gradient calculation of surface nodes w.r.t. control points
- Developed CAD-based shape optimization driver; optimised the shape of S-bend air duct in Volkswagen Golf vehicle, and analysed fluid dynamics at different inlet speeds
- Developed and implemented numerical models for Pressure Retarded Osmosis (PRO) and Reverse Osmosis (RO) membrane process
 - * Developed a membrane model library (in MATLAB), simulating the flow and mass transfer of water and salts in desalination membrane processes;
 - * Implemented particle swarm optimization algorithm, differential evolutionary optimization algorithm, non-dominated sorting genetic algorithm II (NSGA-II) in MATLAB;
 - * Applied the MATLAB-based model library and the implemented optimization algorithms to various applications of system optimization, e.g. optimal operation of desalination system, system design of solar powered desalination, etc.
- Designed/Optimised the spacer shape via gradient-based optimisation driver using discrete adjoint approach and analysed fluid dynamics and filament surface sensitivities
- 2009. 9 - 2012. 7 Postgraduate researcher working on spectral element method for acoustic propagation problem in non-uniform flows
 - Studied Spectral Element Method, the combination of Finite Element and Spectral discretisation methods
 - Derived the mathematical description of acoustic propagation in non-uniform flow
 - Implemented group velocity method with high accuracy on the absorbing boundary conditions (in C++)
- 2008. 9 - 2009. 6 Undergraduate research project: the design of high flow rate vortex/generative blower
 - Impeller design based on empirical correlations in literature and 3D model via software ProE

Selected Publications

1. **Yang Wang** and J.-D. Müller. Re-visit SIMPLE-like algorithms via Pressure Schur Complement for stabilisation of discrete adjoint solver with industrial incompressible flow application. In preparation
2. **Yang Wang**, W. He, and J.-D. Müller. Sensitivity analysis of feed spacer shape in reverse osmosis membrane process using discrete adjoint approach. *Desalination*, 2018. Accepted
3. **Yang Wang**, W. He, and J. Wang. Pumped seawater combined with Compressed Air Energy Storage: an integrated co-storing/producing energy/water system. *Applied Energy*. Under revision
4. W. He, J. Wang, **Yang Wang**, Y. Ding, H. Chen, Y. Wu, and S. Garvey. Study of cycle-to-cycle dynamic characteristics of adiabatic compressed air energy storage using packed bed thermal energy storage. *Energy*, 141:2120 – 2134, 2017
5. **Yang Wang**, W. He, and H. Zhu. Computational fluid dynamics (CFD) based modelling of osmotic energy generation using pressure retarded osmosis (PRO). *Desalination*, 389:98–107, 2016
6. X. Zhang, **Yang Wang**, M. Gugala, and J.-D. Müller. Geometric continuity constraints for adjacent nurbs patches in shape optimisation. *ECCOMAS-2016*, 2016
7. W. He, **Yang Wang**, V. Elyasigomari, and M. H. Shaheed. Evaluation of the detrimental effects in osmotic power assisted reverse osmosis (RO) desalination. *Renewable Energy*, 93:608–619, 2016
8. Y. Geng, G. Qin, **Yang Wang**, and W. He. The research of space-time coupled spectral element method for acoustic wave equationsthe research of space-time coupled spectral element method for acoustic wave equations. *Chinese Journal of Acoustics*, 35(01):31–49, 2016
9. S. Akbarzadeh, **Yang Wang**, and J.-D. Müller. Fixed point discrete adjoint of SIMPLE-like solvers. In *22nd AIAA Computational Fluid Dynamics Conference*, page 2750, 2015
10. **Yang Wang**, S. Akbarzadeh, and J.-D. Müller. Stabilisation of discrete adjoint solvers for incompressible flow. In *22nd AIAA Computational Fluid Dynamics Conference*, page 2749, 2015
11. W. He, **Yang Wang**, and M. H. Shaheed. Maximum power point tracking (MPPT) of a scale-up pressure retarded osmosis (PRO) osmotic power plant. *Applied Energy*, 158:584–596, 2015
12. W. He, **Yang Wang**, and M. H. Shaheed. Stand-alone seawater RO (reverse osmosis) desalination powered by PV (photovoltaic) and PRO (pressure retarded osmosis). *Energy*, 86:423–435, 2015

Awards and grants

- 2015 Postgraduate Research Fund (Queen Mary University of London)
- 2014 Postgraduate student grant (School of Engineering and Material Science, QMUL)
- 2012 Best Postgraduates (Top 10%)
- 2010 Outstanding Postgraduate Student Award (Top 15%)
- 2009 Postgraduate Innovation Fund Scholarship (1st Class, 2/46)
- 2009 Best Graduates (Top 10%)
- 2008 *Fusheng* Industrial Scholarship (1st Class, Top 15%)

Teaching and supervising experiences

- 2012 - 2015 Teaching and demonstrating in undergraduate courses:
 - Heat Transfer and Fluid Mechanics, Mechanics of Fluids and Computer Aided Engineering in Fluids and Solids
- 2012 - 2015 Leader of the segregated flow solver development team:
 - Mentoring junior researchers with code review and implementation
- 2009 - 2012 Instructor in Department of Fluid Machinery