

Stuart Walker PhD MEng MIMechE

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PhD qualified Chartered Mechanical Engineer with post-doctoral and commercial experience.

Strong interest in renewable energy and the environment, and a real passion for engineering.

Key skills in:

- **Experimentation:** Structural and Fluid dynamics using Laser vibrometry and velocimetry, operation and design of acceleration, force, torque and speed sensors, and experience in a range of fluid measurement systems including optical, ultrasonic and acoustic.
- **Computing:** Matlab, Python, LabVIEW, Ansys (Finite Element modelling and Computational Fluid Dynamics), AutoCAD, Rhinoceros, LaTeX, ECHO.
- **Communication:** National & international conferences, public engagement & school presentations. Peer reviewed journal papers in a range of subjects, commercial reports.

Research Experience

Current:

Researcher in Low Carbon Product Design and Development

Institute for Innovation in Sustainable Engineering, University of Derby - Sept. 18

Employed as a multi-skilled low carbon consultant on the ERDF-funded D2EE project, aiming to reduce the carbon emissions of Small and Medium sized enterprises in the Derbyshire region. I am involved in a diverse range of projects utilising many skills, including as examples:

- Development of a machine learning system to identify and classify infrastructure features in images from UAV (drone) photography
- Mathematical (power output and optimal efficiency calculations) and computational (fluid dynamics) modelling of an in-stream hydroelectric generator
- Research and development of a range of low U-value windows and doors suitable for PassivHaus use with full product life cycle assessment and resource accountability
- Design and testing of a prototype of an innovative and potentially ground-breaking small-scale energy generation system
- Process monitoring and sensor development on a drinks manufacturing site to identify and reuse waste process energy

All these projects require a combination of academic rigour, commercial awareness, delivering to tight deadlines and the ability to present work at the required level for a client.

I am also involved in work to raise the profile of the institute and secure its future, for example:

- I was one of four main contributors to a multi-million pound bid for continued funding
- Acting as co-supervisor for two PhD students supported via Rolls Royce
- Part of staff interview panels for new research positions
- Representing the institution at regional events (e.g. Low Carbon Business Network)
- Holding the institute to account and questioning greenwash

In addition to this work, I remain involved in the marine energy industry, and have been awarded funding via the Marinet2 program to test an instrumented turbine at the University of Florence. The focus of this work is the lifetime fatigue effect on performance.

I also continue my work on Life Cycle Assessment and have developed this into the assessment of events. I continue to write journal articles and regularly review articles for a number of journals. I am a member of the University Early Career Researcher network and mentoring scheme.

Post-Doctoral Researcher in Structural Dynamics, University of Sheffield - Jan. 17 to Aug. 18

As part of the University of Sheffield Dynamics Research Group I was the lead experimental researcher on the S^3 – *Disease Surveillance for Systems and Structures* project, under Prof. Keith Worden.

Experimental and computational work, including:

- Design, setup, instrument management, calibration and repair of equipment including scanning laser vibrometer
- Experimental testing using laser vibrometry, accelerometers, force transducers and impact testing
- Signal processing and data analysis (Matlab, Python)
- Development of machine learning algorithms for structural response prediction using Extreme Function Theory
- Finite element modelling and model updating using experimental data
- Preparation of conference and journal papers and presentations

Management of the group and lab, including:

- Supervising and supporting undergraduate and postgraduate student projects, including experimental design, equipment recommendation, teaching and day-to-day assistance
- Responsibility for the use allocation, training and user safety of Scanning Laser Doppler Vibrometer
- Responsible for lab safety, risk assessments, inductions and security

EPSRC Doctoral Prize Researcher, University of Sheffield - Dec. 14 to Dec. 15

Following my PhD I was awarded 12 months' EPSRC funding to continue tidal turbine research. This was undertaken in two sections, at the University of Florence and the University of Sheffield.

Experimental testing of scale models (University of Florence). Major achievements:

- Developed project plan, budget and experimental strategy (during application process)
- Designed and constructed scale model turbines and instrumentation to measure speed and power
- Characterised large water channel to understand boundary layer and turbulence levels
- Recorded flow data using Ultrasonic, Laser and Acoustic Doppler systems
- Analysed large flow data sets using Matlab, e.g. Fourier Transforms and spectral analysis

Computational Fluid Dynamics (CFD) work at the University of Sheffield, including:

- Model construction in CAD and ANSYS CFX software
- Parametric analysis using models of increasing complexity to balance performance and resource
- Comparison of CFD model performance data with experimental results
- Study of turbulence results using Q criterion and vorticity
- Presentation of data and results, writing of formal reports

This work was presented at two European conferences in 2015, and is the subject of a journal article published in 2017. During this project I also helped other researchers and PhD students with experimental water channel work, CFD, and journal article and thesis writing.

PhD Researcher, University of Sheffield - Sept. 10 to Dec. 14

Title: *'Hydrodynamic interactions of a Tidal Stream Turbine and Support Structure'*

Part of the University of Sheffield E-Futures Doctoral Training Program, PhD included a taught first year:

- Current, historical and forecast UK and global energy and resource (inc. water) use and demand
- Detailed study of fossil fuel, nuclear and renewable energy sources
- Projects on Hydrogen burning, Life Cycle Assessment and psychology (resulting in two journal articles)

PhD project major achievements:

- Conducted extensive review of literature on tidal power (resource, technology, economics), hydrodynamics and turbulence, water channel research and instrumentation

- Initiated discussions with commercial partner, resulting in support and access to privileged data
- Constructed instrumented turbines, developing theoretical and practical understanding of sensors
- Used numerous flow measurement methods, e.g. Dye injection, Doppler systems and Particle Image Velocimetry, developing skills in system construction, use, repair and safety issues
- Gained experience in Matlab signal and image processing (e.g. Proper Orthogonal Decomposition of turbulence data) and programming scripts and functions
- Awarded funding via the MARINET transnational access program (EU FP7 “Capacities” Programme)
- Developed understanding of Big Data and interrogation techniques
- Regularly helped other students: PhD, MSc, and undergraduates (laboratory demonstration)

Life Cycle Assessment project with TATA Steel - Sept. 10 to Dec. 15

After collaboration during the first year of my PhD have continued this work alongside my main research. Major aspects of the project:

- Study of embodied energy of Tidal energy devices, both using commercial software (GaBi) and self-developed linked spreadsheet tool using Visual Basic
- Analysis of the impact of Circular Economy principals to part design and reuse
- Development of collaborations and access to TATA Steel data on embodied energy and CO₂
- Published in three peer reviewed articles and at international Life Cycle Management conference
- Presentations and meetings with all levels of TATA Steel research staff

Industry Experience

Graduate Consultant, AECOM Advanced Design Group - Sept. 07 to Sept. 10

Member of a specialist team within the AECOM Buildings Division. Main responsibilities:

- Energy demand modelling and energy planning at building scale
- Working as part of masterplan design teams on energy, water and transport layout
- Development of energy strategy for large project bids (e.g. Qatar 2022 World Cup bid)
- Computational modelling for building regulation compliance, using dynamic thermal modelling
- Specialising in CFD analysis for external wind assessment and internal airflow analysis (managing projects from inception to completion, including all bid work and presentation of findings)

In this role I regularly delivered presentations and prepared reports for clients, building design teams, and planning authorities. I also managed two members of staff when project workload required.

Manufacturing Engineer, Labman Automation - May to Sept. 04

- Assisted in the design and construction of robotic systems for commercial and academic applications
- This role cemented my interest in engineering, aided my practical workshop skills, and introduced me to CAD and computational modelling

Design Engineer, BioGene Research - May to Sept. 02 & 03

- Part of a small team working on the prototype design of DNA testing equipment
- Developed a full construction and assembly guide to allow subsequent batch manufacturing

Management Experience

Chalet Manager (Winter) & Resort Manager (Summer) - Dec. 15 to Oct. 16

After my post-doctoral fellowship my wife and I spent a year in the French Alps. This was planned for 2016 as we both reached the end of fixed-term roles in December 2015. This role developed my management and practical skills:

- Managed a remote 25 person capacity chalet over the winter season.
- Managed three self-catered chalets during the summer season.
- Developed customer service and advanced driving skills

- Improved French and German language skills
- Managed three members of staff in a busy customer-facing environment

Ski Instructor, Sheffield Ski Village - Sept. 04 to Oct. 05

Part-time role during undergraduate degree. Planned and delivered lessons to clients of all ages:

- Attained Snowsport England Club Instructor qualification
- Developed teaching skills for a wide range of audiences, from large groups of 3 year-olds to individual and family lessons for adults

Publications

Thesis:

Walker, S., *Hydrodynamic interactions of a tidal stream turbine and support structure*, University of Sheffield, Departments of Mechanical and Civil and Structural Engineering, December 2014.

Journal articles:

Two articles currently in press (Life Cycle Assessment and Tidal Turbine hydrodynamics)

Walker, S., Hodgson, P., Coleman., N., *Evaluating the environmental dimension of material efficiency strategies relating to the circular economy*, Sustainability, March 2018, **10** (3): p. 666

<http://www.mdpi.com/2071-1050/10/3/666>

Walker, S., Cappiotti, L., *Experimental Studies of Turbulent Intensity around a Tidal Turbine Support Structure*, Energies, April 2017, **10** (4): p. 497

<http://www.mdpi.com/1996-1073/10/4/497>

Walker, S., Howell, R., Hodgson, P., Griffin, A., *Tidal energy machines: A comparative life cycle assessment study*, Proceedings of the Institution of Mechanical Engineers, Part M: Journal of Engineering for the Maritime Environment, May 2015, **229** (2): p. 124-140

<http://pim.sagepub.com/content/229/2/124.abstract>

Kaklamanou, D., Jones, C., Webb, T., Walker, S., *Using Public Transport Can Make Up for Flying Abroad on Holiday: Compensatory Green Beliefs and Environmentally Significant Behavior*, Environment and Behavior, February 2015, **47** (2): p. 184-204

<http://eab.sagepub.com/content/47/2/184>

Walker, S., *Barriers to the deployment of a 100MW tidal energy array in the UK*, International Journal of Energy Engineering, Jun. 2013, **3** (3): p. 80-92

<http://www.ij-ee.org/paperInfo.aspx?PaperID=4571>

Walker, S. and Howell, R., *Life Cycle comparison of a wave and tidal energy device*, Proceedings of the Institution of Mechanical Engineers, Part M: Journal of Engineering for the Maritime Environment, November 2011, **225** (4): p. 325-337

<http://pim.sagepub.com/content/225/4/325.abstract>

Regular reviewer for journals including: Energies; Sustainability; Proceedings of the Institution of Mechanical Engineers; Journal of Cleaner Production.

Conference proceedings:

Walker, S., Lord, C., Dervilis, N., Papatheou, E., Worden, K. *On the use of pseudo-damage to represent damage to structures in population-based Structural Health Monitoring*, ISMA International Conference on Noise and Vibration Engineering, September 2018, Leuven, Belgium.

Walker, S., *Optimising the design of a tidal stream turbine support structure for improved turbine performance*, 11th European Wave and Tidal Energy Conference (EWTEC), September 2015, Nantes.

Walker, S., *Studying tidal stream turbines in the LABIMA DICEA wave-current flume*, 7th International Short Course and Conference on Applied Coastal Research (SCACR), September 2015, Florence.

Coleman, N., Hodgson, P., Walker, S., *Life Cycle Assessment as a Tool for Understanding Material Efficiency Strategies relating to the Circular Economy*, 7th International Conference on Life Cycle Management, August 2015, Bordeaux.

Fung, C., Walker, S., Howell, R., *Effect of the velocity profile of incoming flow on the performance of a horizontal axis tidal stream turbine*, Grand Renewable Energy 2014, August 2014, Tokyo.

Recent Presentations, Posters and Talks:

- 2018 Live interview on BBC Radio Derby regarding life cycle costs and energy generation of a range of renewable energy and energy efficiency technologies
- 2018 Open talk given to University of Sheffield Dynamics Group and attendees from across the faculty.
Dynamics research in Marine Renewable Energy
- 2018 Poster presented at University of Sheffield Dynamics Group Showcase poster presentation.
Experimental and computational studies of nominally similar structures
Winner of best poster prize
- 2017 Presentation given at public engagement event in Sheffield City Centre (The Mobile University).
How Similar is Similar?
- 2017 Participated in conference discussion event (MaRINET2)
MaRINET2: Accessing Europe's ORE Test Facilities
- 2015 Talk given at Short Course on Applied Coastal Research (SCACR), Florence, Italy.
Studying Tidal Stream Turbines in the LABIMA-DICEA Wave-current Flume
Session chair and vice-chair at tidal energy sessions at SCACR
- 2015 Talk given at European Wave and Tidal Energy Conference (EWTEC), Nantes, France.
Optimising the Design of a Tidal Stream Turbine Support Structure for Improved Performance
Session chair and vice-chair at tidal energy sessions at EWTEC
- 2015 Participated in early-stage researcher's workshop (INORE)
Workshop: Does size matter in Marine Renewables? Is bigger better?
- 2014 Talk given at University of Sheffield Engineering Symposium
Improved tidal turbine performance through optimised support structure design
- 2014 Poster presented at University of Sheffield Engineering Symposium
Statistical Analysis in the Wake of a Tidal Stream Turbine
- 2014 Poster presented at Grand Renewable Energy 2014 / AWTEC, Tokyo, Japan.
Statistical Analysis in the Wake of a Tidal Stream Turbine
- 2014 Report published, distributed and publically available via Marinet website
TEDSSWIP Project Marinet Transnational Post-access activity report
- 2014 Talk given to University of Florence LABIMA research group, Florence, Italy.
TEDSSWIP, modelli e esperimenti

Funding Awards

Awarded funding for three weeks laboratory time at University of Florence for a project to develop a lifetime prediction tool for tidal stream turbine foundations, using experimental analysis and statistical modelling.

Urban Flows Observatory Sensor Design Competition - February 2018

Winner of initial stage of sensor design competition, resulting in award of c.£1000 to develop three prototype sensors for testing and development during second stage.

Engineering Researcher Society Development Opportunities fund - February 2018

Award of small grant to fund manufacture of scale model turbine blades, subject to acceptance of MARINET2 application.

MaRINET - June 2015

Awarded funding during final stage of PhD to conduct larger scale experiments at the University of Florence.

Education

PhD (Tidal turbine hydrodynamics) - Dec. 14 (inc. Diploma in Professional Skills)

University of Sheffield (co-supervised by Mechanical & Civil Engineering departments)

MEng Mechanical Engineering (2:1) - July 07

University of Sheffield

Stokesley School & 6th Form College - July 03

A Levels: Design Technology Systems & Control (A) Maths (B); Physics (B);

AS Levels: General Studies (A); German (C)

GCSEs: 10 at A*-B inc. Maths (A), English (A*/ A) and Science (A*)

Public Engagement

- **STEM Ambassador:** St Catherine's Academy student design project (2017/2018)
- **HEA-funded student feedback project:** Appointed as student ambassador on University-wide project, and subsequently employed by RIS in data analysis role (using SPSS statistical analysis software)
- **Web Development:** Founder member and web developer, Sheffield Marine Research Forum
- **Researchers in Residence:** Delivered lessons to students at De Warenne Academy (2012)
- **National Science & Engineering Week:** Presented to large public audience (2011)
- **Festival of the Mind:** Public presentation at 2013 and 2017 'Mobile University' events
- **UCAS visit days:** Led departmental tours for prospective students and parents (2013 & 2014)

Professional Affiliations

- Chartered Mechanical Engineer (Achieved 2013)
- Member of Institute of Mechanical Engineers (MIMechE)
- Member of the Institute of Acoustics
- Member of Energy Institute (MEI)
- Member of early-stage researchers' International Network on Offshore Renewable Energies (INORE)
- STEM Ambassador
- Bloodhound Project (Land speed record car) Ambassador

Training Courses

- Additive Manufacturing and 3D Printing (November 2018)
- Prevent (October 2018)
- Information Governance (October 2018)
- Protecting Personal Information (April 2018)
- Protecting Information (March 2018)

- Unconscious Bias Awareness (February 2018)
- Basic Resuscitation Techniques (April 2017)
- Manual Handling (January 2017)
- Fire Risk (January 2017)

Interests

I enjoy practical engineering, for example having previously built wind turbines, an electric tricycle scooter, a campervan conversion, a remote control dustbin and a kit car. I ran a small mountain bike manufacturing business during my undergraduate degree and in 2016 founded a charity, which now has around 200 members and has been featured in national press.

I enjoy all outdoor sports and am a sponsored ultra-distance runner. Sporting achievements include:

- Qualified UK Athletics run leader for off-road running (FLiRF)
- Elite Sport Ambassador and mentor to talented (Olympic / Team GB standard) undergraduate students
- Raised £7000 for charity Water for Kids through challenges and associated presentations and talks
- Numerous UK race wins and podium finishes
- First UK runner at 2013 Mount Fuji race
- Record-breaking 34-day crossing of the Alps on foot
- Competed at 2013 Adventure Racing World Championships in Costa Rica
- Previous member of the University of Sheffield Elite Sport Performance Scheme
- Committee positions: University Ski Club (Club Captain), University Sports Committee (Treasurer)
- Awarded University Colours for Sport
- Founded "Runners against Rubbish"