Kyle L. Walker

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Research interests

Design/Control of Soft Robotics, Marine Robotics, Predictive Control, Variable Stiffness Mechanisms, Dynamic Control

Education

University of Edinburgh Edinburgh, U.K.
PhD in Marine Robotics (Expected Viva July 2023) Sept. 2019 – Present
Supervisors: Dr. Francesco Giorgio-Serchi, Prof. Adam A. Stokes, Prof. Aristides Kiprakis

University of Strathclyde Glasgow, U.K.
MEng in Electrical and Mechanical Engineering (1:1) Sept. 2014 – Sept. 2019
Dissertation Topic: Design and Control of a Low Cost, Myoelectric Prosthetic Hand.
Contribution: Designed, manufactured and tested the internal electronics and mechatronics of the hand, whilst assisting in debugging and implementation of software for functional operation.

Work Experience

The National Robotarium, Engineering Dept. Edinburgh, U.K.
Job Title: Robotics Engineer March 2023 - Present
Develop and implement robotic solutions for client-driven projects, mainly with industrial partners but covering other sectors as well, such as academia. Specific projects I contribute to are primarily soft/continuum robotics based and involved physical prototyping, testing and implementing control for different platforms.

Bioliberty, Electronics Dept. Edinburgh, U.K.
Job Title: Lead Electronics Design Engineer May 2021 - March 2023
Initially a PhD Placement scheme organised through the University of Edinburgh, which subsequently developed into a contracted part-time role. Working with the company to develop their product, an assistive soft robotic glove for patients suffering hand muscle weakness.

MBDA U.K., Embedded Electronics Dept. Stevenage, U.K.
Job Title: Electronic Circuit Design Intern Summer 2017 and 2018
Summer intern for consecutive years designing and manufacturing PCB's for the assigned projects. Invited to return in 2018 based on performance in 2017. Offered graduate role upon completion but opted to pursue a PhD instead.

Research Experience

Control Methods for Disturbance Mitigation of Underwater Robots in Wave Dominated Environments

Primary Supervisor: Dr. Francesco Giorgi-Serchi Sept. 2019 – March 2023

Summary: Focused on developing methodologies to improve control of remotely operated and autonomous underwater vehicles in shallow and turbulent seas. Main contribution was a Nonlinear Model Predictive Control scheme with an incorporated Deterministic Sea Wave Prediction algorithm, providing wave disturbance preview information to the control for state perturbation mitigation.

Design of Variable Stiffness Soft Robotic Manipulators

Primary Supervisor: Dr. Kenjiro Tadakuma Sept. 2022 – Nov. 2022

Summary: International collaboration with Tohoku University (JSPS fully funded, ≈5k), this project focused on designing manipulators based on continuum concepts, incorporating tunable stiffness into the design. The main focus was on applying tendon driven actuation to control the posture of a three segment, bead-jamming manipulator.

Predictive Wave Disturbance Mitigation for Underwater Soft Robotic Manipulators

Primary Supervisor: Dr. Cosimo Della Santina March. 2022 – June. 2022

Summary: International collaboration with TU Delft (Saltire/SUPA fully funded, ≈5k), this project focused on modelling unsteady fluid disturbances on the soft robotic manipulator, implementing Model Predictive Control to reject these disturbances and generally improving control performance.

Honors, Awards and Scholarships

Emerging Researcher Travel Grant (Saltire Scotland, SUPA)	2022
Travel Grant (IET)	2022
Postgraduate Award (IET)	2021
Summer Program Fellowship Grant (JSPS)	2020
Brightspark Award (Electronics Weekly)	2020
Doctoral Training Partnership (DTP) Scholarship (UKRI EPSRC)	2019

Journal Publications

1. **Analysis of Station Keeping Performance of an Underwater Legged Robot**

M. Chellapurath, K. L. Walker, E. Donato, G. Picardi, S. Stefanni, C. Laschi, F. Giorgio-Serchi and M. Calisti.

IEEE/ASME Transactions on Mechatronics, 2021.

2. **Hydrodynamic Loads on a Restrained ROV Under Waves and Current**

R. Gabl, T. Davey, Y. Cao, Q. Li, B. Li, K. L. Walker, F. Giorgio-Serchi, S. Aracri, A. Kiprakis, A. A Stokes and D. M. Ingram.

Ocean Engineering, 2021.

3. **Experimental Validation of Wave Induced Disturbances for Predictive Station Keeping of a Remotely Operated Vehicle**

K. L. Walker, R. Gabl, S. Aracri, Y. Cao, A. A. Stokes, A. Kiprakis and F. Giorgio-Serchi.

IEEE Robotics and Automation Letters, 2021.

4. **Experimental Force Data of a Restrained ROV Under Waves and Current**
R. Gabl, T. Davey, Y. Cao, Q. Li, B. Li, K. L. Walker, F. Giorgio-Serchi, S. Aracri, A. Kiprakis, A. A Stokes and D. M. Ingram.
MDPI Data, 2020.

Conference Publications

1. **Disturbance Preview for Nonlinear Model Predictive Trajectory Tracking of Underwater Vehicles in Wave Dominated Environments**
K. L. Walker and F. Giorgio-Serchi
International Conference on Intelligent Robots and Systems (IROS), Detroit, 2023.

2. **Feed-forward Disturbance Compensation for Station Keeping in Wave-dominated Environments**
K. L. Walker, A. A. Stokes, A. Kiprakis and F. Giorgio-Serchi.
IEEE/MTS Oceans, Limerick, 2023.

3. **Experimental Validation of Unsteady Wave Induced Loads on a Stationary Remotely Operated Vehicle**
K. L. Walker, R. Gabl, S. Aracri, Y. Cao, A. A. Stokes, A. Kiprakis and F. Giorgio-Serchi.
IEEE International Conference and Robotics Automation (ICRA), Xi'an, 2021.

4. **Investigating PID Control for Station Keeping ROVs**
K. L. Walker, A. A. Stokes, A. Kiprakis and F. Giorgio-Serchi.
UKRAS20 Conference:"Robots into the real world", Lincoln, 2020.

Publications Under Review

1. **Nonlinear Model Predictive Dynamic Positioning of Underwater Robots with Wave Disturbance Preview**
K. L. Walker, L. Beth-Jordan and F. Giorgio-Serchi.
International Journal of Robotics Research, 2023.

2. **Model Predictive Disturbance Rejection for Underwater Soft Robotic Manipulators**
K. L. Walker, C. Della Santina and F. Giorgio-Serchi.
IEEE International Conference on Soft Robotics, 2024.

3. **A Modular, Tendon Driven Variable Stiffness Manipulator with Internal Routing for Improved Stability and Increased Payload Capacity**
K. L. Walker, A. J. Partridge, H.-Y. Chen, R. R. Ramachandran, Adam A. Stokes, K. Tadakuma, L. de la Cruz and F. Giorgio-Serchi.
IEEE International Conference on Robotics and Automation, 2024.

Workshops, Seminars, Talks etc.

(Re)designing the Tree of Robotic Life: A Game of Alternative Timelines

Workshop which focused on bringing together a group of researchers from a wide ranging and diverse set of cultural and academic backgrounds, aiming to develop exciting, unusual and radically different robotic concepts for alternative realities. (**Under Review for ICRA 2024**).

3MT Competition
Sets the challenge to explain your research to an intelligent but non-specialist audience in under 3 minutes with limited visual aids.

Institute Seminars
Presented to research groups and institutes the topic (and branched topics) of my research, ranging from in depth technical talks to general overviews.

Rehab Soft Robotics Summer School 2021
Took part in a summer school covering different concepts and tools relating to soft robotics for healthcare applications.

STEM for Britain Presenter 2020
Presented a poster on my Ph.D. research in the Houses of Parliament in London, discussing my work with Members of Parliament and associates.

Teaching Experience

Co-supervisor, University of Edinburgh 2020-2022
Level: BEng and MEng
Assisted in the guidance of students during their dissertation projects, providing insights where applicable. Projects ranged from modelling of underwater robots to physical design of continuum manipulators.

Teaching Assistant, University of Edinburgh 2019-2022
Classes: Computational Methods and Modelling 3, Dynamics 2, Structural Mechanics and Dynamics 3
Tutored, demonstrated labs and marked assignments for the majority of my Ph.D. duration, gaining experience and improving my ability to teach students and present key concepts effectively. Ranged from classical mechanics theory to implementation of optimisation algorithms within software.

Technical Skills

Programming
MATLAB, Python, C++, ROS/ROS2

CAD Software
Inventor, Solidworks, Fusion360, Rhinoceros 3D

Typesetting
Microsoft, LaTeX

Languages
English (fluent), Spanish (basic)

Other
WAMIT, Arduino, Raspberry Pi, Scuba Diving (Open Water), Mental Health First Aid, Inkscape

Service and outreach

STEM Ambassador Volunteer Jan. 2020 – Present

Visit schools and other educational institutes or events and attempt to encourage younger people into a career in science, technology, engineering and maths.

Paper Reviewer Jan. 2020 – Present

Peer reviewed submissions to journals such as IEEE Robotics and Automation Letters, IEEE Access, MDPI Journal of Marine Science and Engineering amongst others.

Professional Organisations

IEEE Member Sept. 2019 – Present

IEEE Robotics and Automation Society Member Sept. 2019 – Present

IET Member Sept. 2014 – Present

Other interests

Football, Cooking, Baking, Reading, Scuba Diving, Golf, Music.

References

Prof. Adam A. Stokes The University of Edinburgh

contact details

Dr. Cosimo Della Santina TU Delft

contact details

Dr. Francesco Giorgo-Serchi The University of Edinburgh

contact details