

Jon Woolfrey

PhD
Lean Six Sigma Black Belt
BE Mechatronics (Hons.)
Cert. IV Mechanical Trades

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Technical Skills

- Statistical analysis & modelling
- Mathematical optimisation
- Predictive & optimal control
- Classical mechanics
- C++ programming

Soft Skills

- Project management
- Structured problem solving
(e.g. Six Sigma, DMAIC)
- Root cause analysis & systems thinking
- Workshop facilitation & cross-functional collaboration

Languages

🇬🇧 English (Native)
🇮🇹 Italian (Intermediate)

Work Experience

January 2026 -
Present

Independent Business & Engineering Consultant *Sydney, Australia*

- Leading a business process improvement investigation with an estimated impact of \$500,000 for [The Butcher's Pantry](#) involving:
 - Designing & analysing customer surveys,
 - Identifying key performance indicators for analysis, and
 - Hosting root-cause analysis workshops.
- Developing force-feedback control algorithms for [Crest Robotics](#) to enable remote operation of high-voltage switchgear to reduce human exposure to hazards.
- Collaborating with the Italian Institute of Technology to develop predictive control for dynamic collision avoidance of mobile robots involving:
 - Designing reusable C++ software architecture for trajectory generation & control, and
 - Integrating this into a [ROS2 Nav2](#) plugin for deployment on the [R1 humanoid robot](#).
- Collaborating with the University of Technology Sydney on nonlinear regression to characterise the behaviour of non-Newtonian fluids (oobleck) for force control in human-robot interaction.

- February 2024 - **Research Fellow**
January 2026 *University of Leeds, United Kingdom*
- Provided expertise on software design & control methods for the [Terabotics programme](#) (high-frequency light sensors with robotic systems in cancer diagnosis).
 - Secured **£22,000** in competitive, and international research funding.
 - Principal Investigator on an international collaboration for magnetic tentacle robots in cardiac intervention with the University of Technology Sydney, and Chinese University of Hong Kong.
 - Designed and implemented a [C++ robotics control library](#) with modular [ROS2 action servers](#) to support complex robot manipulation tasks.
 - Led a [cross-disciplinary workshop](#) between physicists and engineers for a mini-project involving:
 - Enumerating engineering specifications,
 - Identifying risks & countermeasures, and
 - Sequencing task dependencies.
- July 2021 - **Postdoc**
December 2023 *Istituto Italiano di Tecnologia*
- Team leader for Humanoid Sensing & Perception on the [ergoCub humanoid robot project](#):
 - Led [collaborative planning workshops](#),
 - Directed Agile sprints to meet project deadlines, and
 - Chaired weekly project progress meetings.
 - Designed and implemented [C++ bimanual control classes](#) for the ergoCub and iCub2 robots.
 - Developed and deployed a [convex optimization algorithm](#) for real-time robot control.
 - Developed interface definition layers (IDLs) for controlling a humanoid robot as part of an [autonomous humanrobot interaction system](#) involving perception and decision trees.
- May 2019 - **Research Associate**
June 2021 *Centre for Autonomous Systems (now Robotics Institute), University of Technology Sydney*
- Developed a custom [MATLAB toolbox](#) for simulation and real-time control of robotic arms.
 - Published research on real-time motion prediction & control in a top-tier robotics journal, *IEEE Transactions on Robotics (T-RO)*.

February 2015 -
May 2019

Doctoral Candidate

Centre for Autonomous Systems (now Robotics Institute), University of Technology Sydney

- Contributed to the [Submerged Pile Inspection Robot](#) by:
 - Designing mechanical components in SolidWorks,
 - Developing technical drawings for production, and
 - Developing a hierarchy and version control system to manage engineering files.
- Led [collaborative design workshops](#) for prototype development to:
 - Identify critical use cases,
 - Enumerate engineering specifications, and
 - Brainstorm innovative features.
- Developed predictive control algorithms in C++ for robot arms on moving platforms.
- Collected and analyzed time-series data for wave motion prediction, implementing real-time forecasting algorithms in MATLAB.

December 2011 -
December 2014

Engineering Scholar & Lean Six Sigma Project Manager

Maintenance Directorate, Sydney Trains

- Led a project to save **\$1,900,000 / year** on intercity train pantograph collector strip wear involving:
 - Measurement system analysis of gauges,
 - Regression modeling of wear rates, and
 - Hypothesis testing to identify root causes.
- Led a project to save **\$100,000 / year** in labour costs by optimising train inspections using:
 - Root cause analysis with fishbone (Ishikawa) diagrams, and
 - Process mapping and task sequencing to reduce inspection time.
- Managed cross-functional stakeholder engagement across engineering, operations, and management teams to ensure project alignment and success.
- Investigated systemic causes of train punctuality and prepared reports for senior management.

April 2007 -
March 2011

Maintenance Fitter

Precision Valve Australia

- Conducted preventative & reactive maintenance on assembly machines for aerosol valves:
 - Increased output from **114% to 140%** on a sub-assembly machine by identifying & rectifying excess movement the pulley system.
 - Improved yield from **84% to 98%** on a machine by identifying and reducing variation in diameter of the spring component.
- Fabricated, and modified small machine parts to reduce machine downtime, and increase yield.
- Applied 5S¹ methodology to the production area, improving organisation and workflow.
- Authored and compiled reports on product defects, and machine reliability, for management, and international customers.

2006 - **Barista & Server**
2007 *Jester's Pies Panania*

- Managed stock-keeping, inventory ordering, and daily opening/closing procedures.
- Delivered attentive customer service, building positive relationships and repeat business.
- Recognized for barista skills; frequently requested by management to assist on high-demand days.
- Disseminated expertise with other staff on coffee preparation techniques and machine maintenance.

Education

2015 - **Doctor of Philosophy**
2020 *University of Technology Sydney*

Thesis: *Control of Manipulators on Moving Platforms Under Disturbance*

Mobile robots, such as underwater vehicles, drones, and rovers, are now being combined with manipulators to perform a variety of work in the field. But current state of the art in control assumes that disturbances from the environment are minimal. However, the effects of wind, waves, and rough terrain may make it difficult for the vehicle to maintain a steady base for the manipulator. Or, in some cases, the vehicle may lack the control authority to negate disturbances in all directions. In this thesis, predictions of the base motion are used to formulate control strategies that enable a manipulator to proactively counter, and even make use of, these disturbances.

2010 - **B.E. Mechanical & Mechatronic Engineering (1st Class Honors)**
2014 *University of Technology Sydney*

- Ranked in the top 15% of all UTS students in 2012.
- Electives:
 - Design Optimisation for Manufacturing
 - Control of Mechatronics Systems
 - Advanced Robotics
 - Biomedical Instrumentation
- **Honors thesis:** *"A Systems Thinking Approach to Pantograph Collector Strip Wear"* Examined interrelated causal factors contributing to collector strip wear on train pantographs.

2007 - **Certificate IV in Mechanical Trades (MEM40105)**
2009 *South Western Sydney Institute of TAFE*

Key competencies:

- Complex milling and turning (gear cutting, thread cutting, eccentric turning).
- Advanced fitting techniques (pipe bending, mechanical seals, shrink/expansion fitting, non-destructive bearing removal, wheel balancing).
- Machine installation, alignment, and floor planning.
- Fault diagnosis and repair of mechanical systems.
- MIG welding.

2000 - 2005	Higher School Certificate <i>St Mary's Cathedral College, Sydney</i> - Received a certificate for perfect attendance in Grade 11 (2004) and Grade 12 (2005). - Member of the competitive swimming team; represented school at multiple state-level competitions. - Electives included: 3 Unit Advanced English 3 Unit Advanced Mathematics 2 Unit Information Technology 2 Unit Studies of Religion
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Other Qualifications

2017	Lean Six Sigma Black Belt <i>UTS Business School</i>
2014	Lean Six Sigma Green Belt <i>Sydney Trains</i>
2009	Certificate III in Competitive Manufacturing <i>Skillup Australia</i>
2005	Certificate II in Information Technology (ICA20199) <i>Board of Studies NSW</i>
2011	National OHS Construction Induction Safety Training (White Card) <i>SafeWork New South Wales</i>
2011	Work Safely in the Construction Industry <i>Advance OHS</i>
2011	Rail Industry Safety Induction <i>RailCorp (now Sydney Trains)</i>

Teaching & Supervision

2025 - Present	PhD Co-Supervisor <i>University of Technology Sydney</i> - Co-supervising a PhD student researching model predictive contouring control applied to robotic hip replacement surgery. - Mentoring in control theory, fundamental robotics concepts, and research methods, including experimental design, simulation, and implementation. - Coaching the student on articulating research problems, solutions, and benefits to both professional and academic audiences. - Providing guidance in C++ programming to support simulation, testing, and integration of robotic control algorithms.
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2018 -
Present

Guest Lecturer, Teaching Assistant

Lean Six Sigma Yellow Belt Certification Program

Technische Universität München (via edX.org, Coursera)

- Delivered guest lectures on advanced topics in Lean manufacturing and the Toyota Production System, connecting theory to real-world professional practice.
- Actively engaged with hundreds of thousands of students worldwide via online forums, answering questions, providing applied examples, and facilitating discussions.
- Delivered live information sessions on Lean Six Sigma professional practice, responding to participant questions and encouraging course engagement.
- Contributed to course development and learning experience for a globally ranked top 10 online course of all time (Class Central).

2016 -
Present

Casual Academic

Industrial Robotics, Mechanical & Mechatronic Design

University of Technology Sydney

- Helped design & develop the Industrial Robotics subject when it first launched in 2016:
 - Recorded core lecture videos, which have been seen by tens of thousands of people on YouTube,
 - Designed and developed tutorial exercises, and
 - Developed online learning material for the UTS Canvas platform.
- Developed lecture content for the Mechanical & Mechatronic Design subject.
- Supervised and mentored students in tutorials, laboratories, and design projects.
- Participated in project review panels & live student assessments, evaluating outcomes and offering constructive feedback.

Publications

- Greenidge, N. J., Calmé, B., Moldovan, A. C., Abaravicius, B., Martin, J. W., Marahrens, N., Woolfrey, J., Scaglioni, B., Chathuranga, D. S., Mitra, S., et al. (2025). Harnessing the oloid shape in magnetically driven robots to enable high-resolution ultrasound imaging. *Science Robotics*, 10(100):eadq4198
- Cheng, C., Li, T., Woolfrey, J., Zhao, L., and Huang, S. (2024). Robot drawing on a moving paperboard. In *Australasian Conference on Robotics and Automation Acra*
- Woolfrey, J., Ajoudani, A., Lu, W., and Natale, L. (2024). Optimal configurations for stiffness and compliance in human & robot arms. *Plos one*, 19(5):e0302987
- Woolfrey, J. and Liu, D. (2022). An optimal dynamic control method for robots with virtual links. In *2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pages 12843–12848. IEEE
- Woolfrey, J., Lu, W., and Liu, D. (2021). Predictive end-effector control of manipulators on moving platforms under disturbance. *IEEE Transactions on Robotics*, 37(6):2210–2217
- Sutjipto, S., Woolfrey, J., Carmichael, M. G., and Paul, G. (2021). Cartesian inertia optimization via redundancy resolution for physical human-robot interaction. In *17th IEEE International Conference on Automation Science and Engineering*, pages 570–575. IEEE
- Byun, H., Kim, J., Liu, D., and Woolfrey, J. (2021). Towards a pantograph-based interventional auv for under-ice measurement. *arXiv preprint arXiv:2109.14182*
- Woolfrey, J., Lu, W., Vidal-Calleja, T., and Liu, D. (2019b). Clarifying clairvoyance: Analysis of forecasting models for near-sinusoidal periodic motion as applied to auvs in shallow bathymetry. *Ocean Engineering*, 190:106385
- Woolfrey, J., Lu, W., and Liu, D. (2019a). A control method for joint torque minimization of redundant manipulators handling large external forces. *Journal of Intelligent & Robotic Systems*, 96(1):3–16
- Woolfrey, J., Liu, D., and Carmichael, M. (2016). Kinematic control of an autonomous underwater vehicle-manipulator system (auvms) using autoregressive prediction of vehicle motion and model predictive control. In *IEEE International Conference on Robotics & Automation*, pages 4591–4596. IEEE

Referees

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