



Reference Guide to Research & Development

in the
Department of Mechanical Engineering



UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

2026-2027



Welcome from the Head of Department	1
Why Postgraduate Study?	2
Funding	3
Career Possibilities and Support	4
EBE Postgraduate Journey	5
Advanced Machining Laboratory	6
Applied Thermofluid Process Modelling Research Unit (ATProM)	7
Blast Impact and Survivability Research Unit (BISRU)	8
Centre for Materials Engineering (CME)	9
Aluminium Research Group	10
Centre for Research in Computational and Applied Mechanics (CERECAM)	11
Composite Materials Laboratory and 3D Printing	12
Engineering Education	13
Industrial Computational Fluid Dynamics (InCFD)	14
Mechatronic Systems Group	15
Tutoring	16
Links to Important Information	17

Welcome from the Head of Department



The Department of Mechanical Engineering at UCT provides an excellent space for teaching, learning, and research. We continue to improve the research environment and provide you with excellent opportunities to conduct innovative research as you plan to join our department to pursue postgraduate study in different fields of Mechanical Engineering. The decision to enrol in postgraduate study is complicated as many excellent career opportunities are open to you after your bachelor's degree programme. As a new mechanical engineering graduate, you are exposed to excellent job opportunities; however, how can you ensure that you stand out from other excellent job applicants? One way to stand out is to pursue a postgraduate degree.

Besides the obvious benefits of gaining specialist technical knowledge and skills, postgraduate study also offers the opportunity for immense personal development. Completing a postgraduate degree will require you to develop a range of transferable skills in problem-solving, project management, communication, critical thinking, data analysis, organisation, and time management. That is why we find so many engineers with postgraduate qualifications working as successful financial analysts, investment managers, and CEOs of companies (and, of course, in engineering!).

The Department of Mechanical Engineering at UCT has compiled this Research Reference Guide to help you explore postgraduate study.

I invite you to explore the wide range of postgraduate research activities available. I have no doubt that this will really benefit your future!

Kind regards

Prof. Tunde Bello-Ochende



Your undergraduate journey of growth, discovery and learning has given you a broad and solid foundation in mechanical or mechanical, and mechatronic engineering. Through your studies, you have explored a range of topics and honed critical problem-solving skills. Now, as you stand on the threshold of the next phase of your life, exciting opportunities await you.

We live in an era of rapid technological advancements and complex global challenges. A postgraduate degree from our department will certainly provide you with deeper insights into your chosen field, we have a range to choose from, and the ability to innovate at the highest level to thrive and lead in this ever-changing landscape. Whether you choose to pursue a career in industry, academia, or as an entrepreneur, further studies will equip you with advanced skills and experiences necessary to make a meaningful impact and provide you with more opportunities.

You have already or about to complete your undergraduate degree and thinking *“What’s next? —take a break or enter the workforce or pursue further studies”*. Job opportunities are tempting. However, investing in a postgraduate degree is a strategic decision that will enhance your long-term career prospects. Beyond technical knowledge, postgraduate studies will further develop your critical thinking, leadership and independent research and learning – which are all attributes that are highly valued across all professional sectors.

Our department has prepared this research guide, offering some insights into the different research opportunities, and funding avenues to help you navigate this decision. Explore your options, speak with different staff members whose work aligns with your interests, and seek out funding opportunities to support your journey.

Your future is full of possibilities, and we encourage you to embrace this opportunity to unleash your potential for better success. Wishing you the very best as you take the next step in shaping your future.

Steve Chung Kim Yuen

NRF POSTGRADUATE SCHOLARSHIP 2026 (FULL-TIME STUDIES)

The National Research Foundation (NRF) minimum academic requirement for postgraduate funding is 65%. Applicants for honours, masters and doctoral funding must be 28, 30 and 32 years of age or younger respectively in the year of application.

Successful applicants will be funded either at Full Cost of Study (FCS) or Partial Cost of Study (PCS). The FCS funding will be awarded to South African citizens and permanent residents only, who are either financially needy (i.e. those whose combined household family income is less or equal to R350 000 per annum), living with a disability or exceptional academic achievers.

However, PCS funding will be awarded to 5% of international students including South African citizens and permanent residents who could not be funded under FCS but meet other minimum requirements for the NRF scholarship funding criteria.

ELIGIBILITY CRITERIA

Honours: Only South African citizens and permanent residents are eligible for honours bursaries.

Masters & Doctoral: open to South African citizens, permanent residents as well as a limited percentage of foreign nationals who will be registering at South African public universities in 2026 on a full-time basis only.

Please refer to the link below for further NRF information and for the Application and Funding Guide and Framework documents which are now available.

[Research scholarships | University of Cape Town \(uct.ac.za\)](https://nrfconnect.nrf.ac.za)

All postgraduate students will be expected to apply on the NRF. Connect system by accessing the link: <https://nrfconnect.nrf.ac.za/> No manual applications will be accepted. All applicants applying for financial need should complete and upload the ISFAP Application Consent Form. Honours students should ensure that they submit an MOU agreed and signed by the student and HOD clarifying expectations.

Maximum period of support – Honours: 1 year, Masters: 2 years, Doctoral: 3 years, Extension funding: 6- or 12- months.

UCT INTERNAL DEADLINES FOR 2026 FUNDING:

Masters and Doctoral First-Time Applications: **15 June 2026**

Extension Support: Masters / Doctoral Applications: **3 August 2026**

Honours Applications: **31 October 2026**

IMPORTANT NOTE:

Students are urged to apply for both UCT and NRF scholarships. UCT will reject applications submitted after the UCT internal closing dates as indicated above.

Questions?

Email : nrfdasupport@uct.ac.za

Call : 021 6503622 option 3

Book a consultation : bit.ly/pgfohelpdesk

Own Your Future



Postgrad Section



THE BENEFITS OF POSTGRADUATE STUDY

- Higherearningpotential
- Enhanceyouremployability
- Explore and acquire new skills beyond the undergraduate level to broaden your knowledge and expertise.
- Enablescross-disciplinary options
- Startingpointfor an academiccareer

OPTIONS WITH THIS DEGREE

- Graduates work in many different contexts in subject related work but also use their transferable skills and work in consulting, finance, data science and various entrepreneurial pursuits.
- For example, search LinkedIn for MSc Mechanical Engineering and select People to browse the profiles of graduates in jobs that interest you.



 [Play Webinar](#)

[Go to 2025 Career Guide](#)

careers.uct.ac.za



@UCT Careers Service

mycareer.uct.ac.za



@UCTCareers

careers.service@uct.ac.za



@uctcareersservice

HOW THE CAREERS SERVICE CAN HELP

- Job expos, company presentations and career development webinars
- Advertised opportunities on the mycareer.uct.ac.za job portal
- Help with applications, CVs, LinkedIn profiles and interview preparation
- Mock Interview Programme with feedback from employers
- One-on-one career consultations
- Entrepreneurial support



POSTGRADUATE STUDIES IN EBE

The Faculty of EBE offers a number of postgraduate degrees. These include Honours qualifications, Master of Science (MSc), Master of Engineering (MEng), Master of Philosophy (MPhil) and Doctor of Philosophy (PhD). These qualifications are locally and internationally acclaimed.

THE BENEFITS OF STUDYING POSTGRAD

A postgraduate degree gives you a framework to critically and creatively solve issues faced by society. It deepens your knowledge of your chosen research area and increases your employability. Apart from the many career benefits, an EBE postgraduate degree strengthens personal growth, improves written communication, creativity and networking skills.

SKILLS AND TOOLS GAINED AS A POSTGRAD

- Working collaboratively with people from different backgrounds.
- Cost-effectivewayto buildnetworks.
- Creativeproblemsolving.
- Applyingcriticalresearchand enquiryskills.
- Independentthinkingandcriticalevaluation.
- Effectivecommunication.
- Personalgrowth.
- Buildingprofessionalcredentials.
- Time managementskills.

POTENTIAL PITFALLS AND HOW TO AVOID THEM

As a postgraduate student you have increased self-accountability. You have the freedom to work at your own pace. However, this freedom comes with the responsibility of being disciplined and having to take initiative. Another important element is consistent and honest communication with your supervisor.



WHOWEARE & WHATWE DO

The Advanced Machining Lab (AML) is a research and innovation hub within the Department of Mechanical Engineering at the University of Cape Town. We focus on the development of next-generation machining systems that combine high-speed performance, ultra-precision, and intelligent adaptability.

Our team comprises academic staff, postgraduate students, and industry collaborators, working together to advance manufacturing science and engineering. A key industry partner is Protea Machine Tools (PMT), a local technology company founded on research originating from our own department. PMT plays a critical role in the commercial translation of our work—bridging the gap between lab-scale innovation and real-world application.

At AML, we:

- Design and develop custom machine tools, including advanced hybrid serial-parallel 5-axis platforms created in collaboration with Protea Machine Tools.
- Integrate intelligent, adaptive control systems for real-time monitoring, quality assurance, and autonomous process correction.
- Conduct experimental and simulation-based research on machining dynamics, toolpath optimization, and precision system design.
- Collaborate with industry to address challenges in manufacturability, productivity, and sustainability—often through technology transfer frameworks.
- Support Protea Machine Tools in the prototyping and refinement of commercial machine tool offerings, with postgraduate students often contributing directly to R&D and field implementation.
- Equip students with practical research and design skills, grounding advanced manufacturing knowledge in hands-on learning.

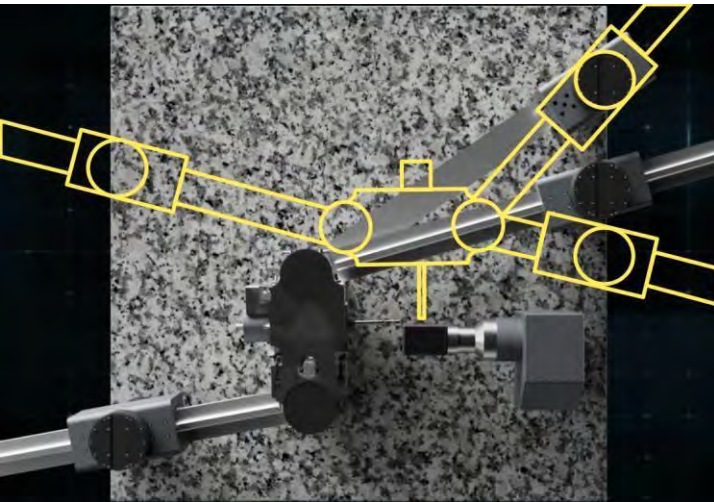
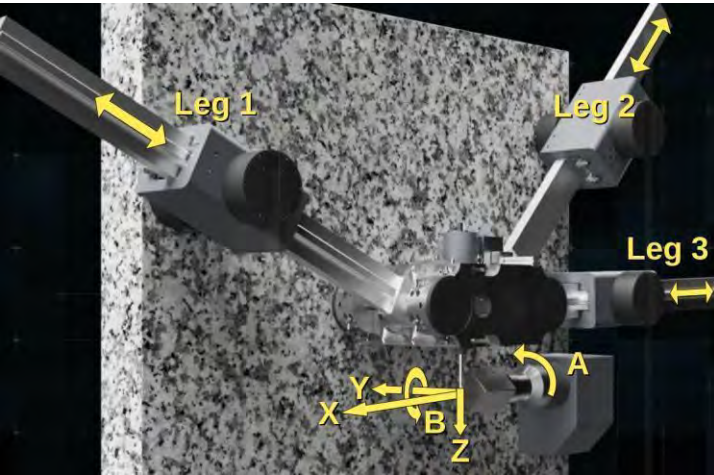
We are driven by a shared vision: to make South Africa a global player in advanced manufacturing technologies, leveraging academic research and industry partnerships like PMT to realize real-world impact.

CONTACT DETAILS

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PROTEA MACHINE TOOLS

WHO WE ARE

Dr. Leon Malan, Mr. Colindu Sart, Hon. Prof. Pieter Rousseau, Adj. A/Prof. Wim Fuls.

WHAT WE DO

Rising energy demand amidst energy systems transitioning rapidly to distributed generation and increasing volumes of renewables are important engineering challenges. Thermofluid systems provide the backbone of almost all energy conversion processes for renewable and conventional power generation, as well as heating and cooling systems such as heat pumps and refrigeration cycles.

The Applied Thermofluid Process Modelling Research Unit (ATProM) specialises in modelling these systems to evaluate novel technologies, improve the efficiency and control of processes, and detect anomalies for condition monitoring purposes.

Fundamental models are built using detail computational fluid dynamics (CFD) and integrated one-dimensional thermofluid networks.

This unique combination of fundamental thermofluid principles and machine learning techniques enable the development of accurate and computationally inexpensive numerical tools to address industry needs.

CURRENT RESEARCH FOCUS

- Supercritical CO₂ (sCO₂) power cycles
- Concentrated Solar Power (CSP) plants
- Biomass energy conversion
- Coal-fired power plants, gas turbines and combined cycles
- Ammonia co-firing
- Physics-informed neural networks (PINN) application to energy systems

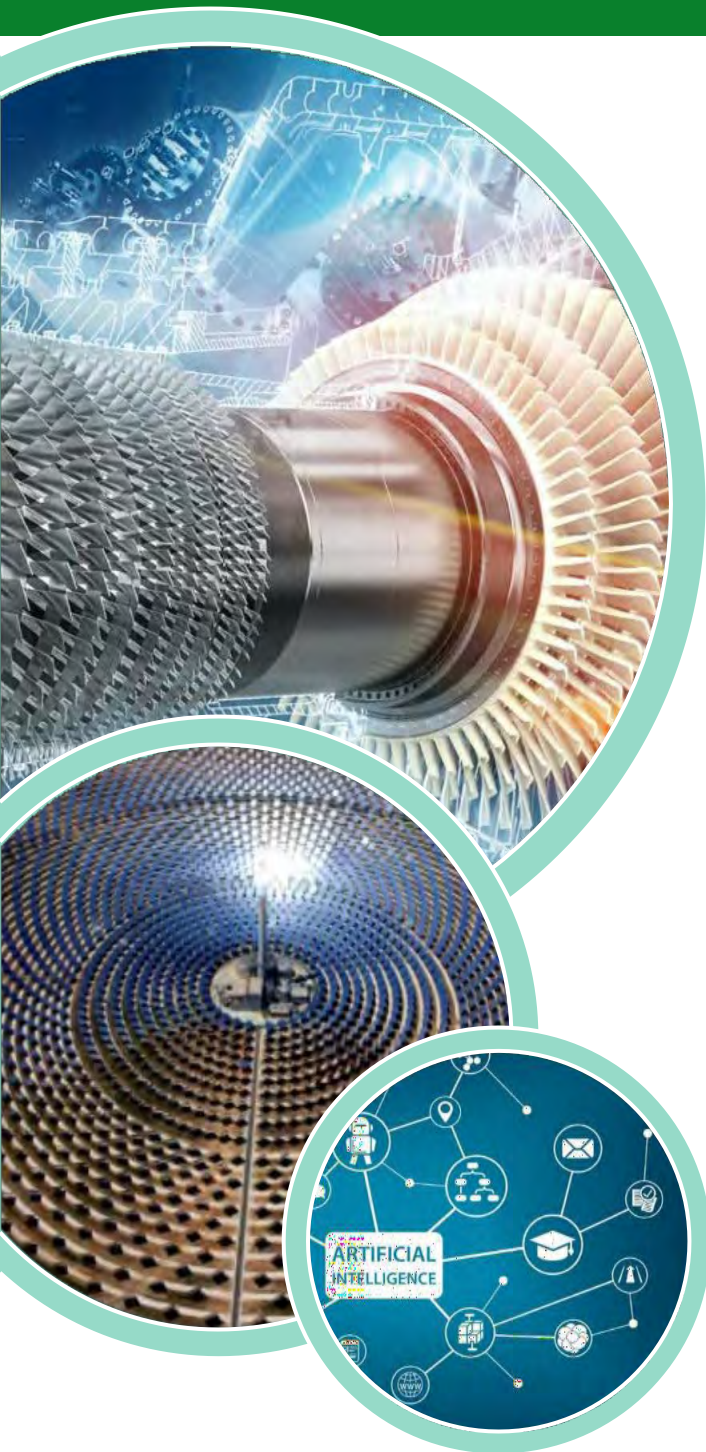
SPECIALISED FACILITIES

- Specialized CFD and thermofluid process modelling software.
- Access to high performance computing.
- Close collaboration with industry partners.

RECENT PUBLICATIONS

- Laubscher R., Rousseau, P.G. Malan L, and De Villiers E. 2024. Thermofluid process simulation of wet biomass and ammonia co-firing in an industrial watertube boiler, Proceedings of the Institution of Mechanical Engineers, Part A: Journal of Power and Energy
- Laubscher R., Rousseau, P.G. vander Spuy, S.J., du Sart C.F., and Pretorius, J.P. 2024. Development of a 1D network-based momentum equation incorporating pseudo advection terms for real gas sCO₂ centrifugal compressors which addresses the influence of the polytropic path shape, Thermal Science and Engineering Progress, Volume 55
- du Sart, C.F., Rousseau, P.G. and Laubscher, R. 2024. Comparing the partial cooling and recompression cycles for a 50 MWe sCO₂ CSP plant using detailed recuperator models, Renewable Energy 222
- du Sart, C.F., Rousseau, P.G. and Laubscher, R. 2024. A method to develop centrifugal compressor performance maps for off-design and dynamic simulation studies of sCO₂ cycles, Proceedings of the 8th international CO₂ power cycle symposium

WEBSITE: www.atprom.uct.ac.za EMAIL: atprom@uct.ac.za



WHO WE ARE & WHAT WE DO

The Blast Impact and Survivability Research Centre (BISRU) focuses on the fundamental understanding of blast and structural impact scenarios. BISRU currently operates a unique suite of blast impact assessment equipment located at its own test facility. Our research focus seeks to save lives and reduce the risk of injuries that may arise from extreme loading events in addition to understanding the mechanics and dynamics of blast and impact loads. Our research activities are aimed at promoting the investigation and understanding of impact dynamics through both analytical, numerical simulation and laboratory based studies. BISRU is involved in several multi year programmes to study the loading and damage caused by explosions and to develop blast resistant lightweight materials or structures. Research in our facility also seeks to understand the properties of homogeneous materials as well as biological, cellular and multi layered materials under blast and impact conditions.

CURRENT RESEARCH FOCUS

- Blast load characterisation
- Material characterisation at very high strain rates
- Structural response to blast loading
- Buried charges (landmines)
- Energy absorbers in crashworthiness and blast application
- Prediction and measurement of human body response to blast and impact events
- Characteristics of bio-materials

KEY RESEARCH COLLABORATORS

- Beijing Institute of Technology (China)
- Saint Cyr Military Academy (France)
- University of Sheffield (UK)
- University of Southampton (UK)

SPECIALISED FACILITIES

- Computational software and high capacity servers for finite element analysis
- Blast chamber
- Ballistic pendulum
- Droptesters
- DIC systems
- Composite manufacturing equipment
- Gas gun for ballistic penetration studies
- Hopkinson Bar apparatus (variable configurations including tension & compression)

SAMPLE PUBLICATIONS

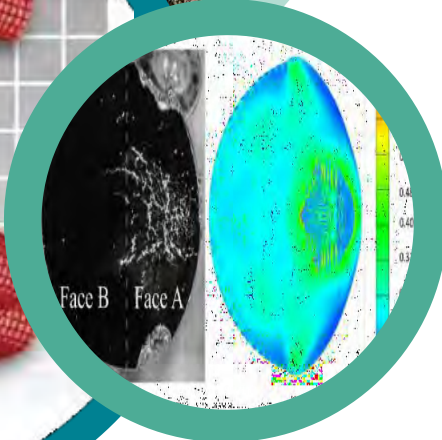
- The Effect of Scaling Building Configuration Blast Experiments on Positive Phase Blast Wave Parameters, S. Gabriel, J. Denny, S. Chung Kim Yuen, G.S. Langdon, R.A. Govender, Applied Science, Vol 13, 2023.
- Round Robin test of Split Hopkinson Pressure Bar, M.A. Kariem, R.C. Santiago, R.A. Govender, D.W. Shu, D. Ruan, G.N. Nurick, M. Alves, G. Lu, G.S. Langdon, International Journal of Impact Engineering, Vol. 126, pp 62-75, April 2019
- The behaviour of cancellous bone from quasi-static to dynamic strain rates with emphasis on the intermediate regime, M. Prot, T.J. Cloete, D. Saletti, S. Laporte, Journal of Biomechanics, Vol 49(73), May 2016.

CONTACT INFORMATION

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WHOWE ARE



Prof
Thorsten
Becker



James
Dicks



Dr
Sarah
George



Dr
Sherlyn
Gabriel



Dr
Nasheeta
Hanief



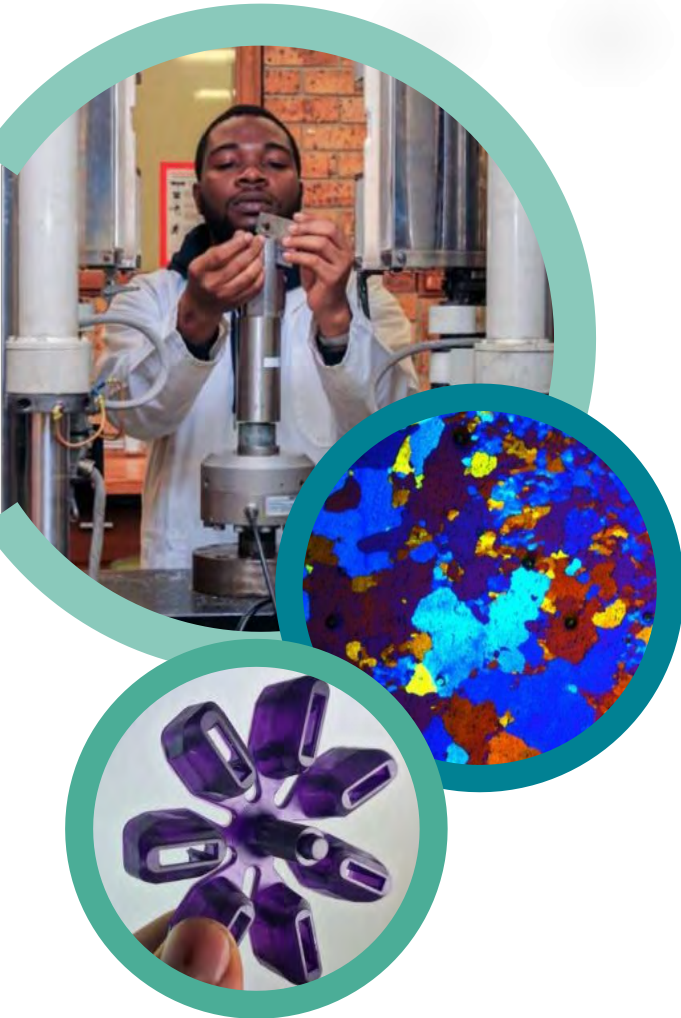
A/Prof
Wei Hua
Ho



Ernesto
Ismail



James
Hepworth



WHAT WE DO

The Centre for Materials Engineering (CME) conducts research to tackle pressing industry challenges while enhancing the understanding of materials science. We aim to investigate the relationship between processing techniques, structural characteristics, and property behaviour across a variety of materials, including metals, polymers, ceramics, and composites.

CME supports local and global research initiatives in manufacturing process optimisation and property assessments to better align with processing and service demands. We also strive to boost the competitiveness of South African industries by promoting their growth. Our state-of-the-art laboratory facilities enable advanced characterisation and property measurements, resulting in widely cited publications.

Nationally esteemed and internationally recognised, CME possesses a wealth of expertise and capabilities in materials-related research. Our robust academic and technical expertise fosters a vibrant postgraduate environment, nurturing the development of South Africa's future Materials Engineering researchers.

CURRENT RESEARCH FOCUS

- High-temperature and high-stress performance of materials.
- Additive manufacturing of titanium, steel, nickel-based superalloys, and aluminium components.
- Development of aluminium beverage can stock processes.
- Digital image and volume correlation.
- Visualisation and quantitative characterisation using high-resolution electron microscopy.
- Biodegradable polymers and foams derived from vegetable oils.
- Development and characterisation of biobased composites.

KEY RESEARCH COLLABORATORS

- DSTI (SA)
- CERECAM (UCT)
- Hulamin (SA)
- BISRU (UCT)
- CSIR (SA)
- Stellenbosch University (SA)
- Universities of Oxford (UK)
- Nelson Mandela University (SA)
- Glasgow, Bristol (UK)
- Central University of Technology (SA)
- KU Leuven (BE)
- TU Delft (NL)

RECENT PUBLICATIONS

James Dicks, Chris Woolard, 2025. Thiol-X Chemistry: A Skeleton Key Unlocking Advanced Polymers in Additive Manufacturing” in Macromolecular Materials and Engineering.
<https://doi.org/10.1002/mame.202400445>

Website: ebe.uct.ac.za/materials-engineering

List of current postgraduate projects:

ebe.uct.ac.za/materials-engineering/people/postgraduate-students

WHO WE ARE

The Aluminium Research Group (ARG) is a newly formed multidisciplinary research team focused on advancing aluminium alloy fabrication and semi-fabrication processes in South Africa. Led by Dr. Sarah George, ARG brings together expertise from the Centre for Materials Engineering, CERECAM, and the MMT research group within UCT's Department of Mechanical Engineering.

WHAT WE DO

For years, UCT has been at the forefront of aluminium research, with a strong collaborative partnership with Hualamin Rolled Products. This partnership has played a pivotal role in establishing aluminium metallurgy as a key research focus, fostering the group's reputation as a leading authority in South Africa on wrought aluminium products and processes. The Aluminium Federation of South Africa (AFSA) also endorses the group, further cementing its industry relevance.

RESEARCH FOCUS

Driven by industrial and applied research, ARG primarily investigates hot rolling processes in collaboration with Hualamin. Our research spans multiple facets of aluminium processing and the broader value chain, aiming to generate insights that directly benefit the industry and contribute to its economic growth.

Our expertise includes:

- Experimental physical metallurgy
- Microstructural characterization and microscopy
- Computational and modelling techniques
- Sensor technology and parameter monitoring

Currently, the ARG is engaged in a Department of Trade, Industry and Competition (dtic) THRIP-funded project with Hualamin Rolled Products. This funding enables postgraduate research, engineering internships, and staff support, fostering innovation and the next generation of industry leaders.

CURRENT POSTGRADUATE PROJECTS

Masters Projects

- Characterisation of features and property changes during beverage can neck forming processes in AA3104 CBS: an experimental approach and a modelling approach (2 students working in parallel).
- Quantification and characterisation of dispersoids in AA3104 beverage can body alloy after homogenisation.
- Development of a Nakajima forming capability for the development of forming limit diagrams for automotive body sheet alloys.

PhD Projects

- Recycling of used beverage cans, a novel approach the composition refinement
- Investigation into the mechanisms causing strengthening during cold rolling of AA3104 beverage can body alloy.



WHO WE ARE & WHAT WE DO

The principal objective of the Centre for Research in Computational and Applied Mechanics (CERECAM) is to provide a coherent focus and point of interaction for research in the area of non-linear mechanics, by promoting and supporting fundamental research and applied research. A major area of interest is in computational mechanics i.e. the computational simulation of flow, deformation and failure in natural processes, engineering components or artefacts. Other research interests focus on theoretical studies in solid and fluid mechanics, partial differential equations, computational algorithms and experimental studies. CERECAM has as a key objective to be the centre of expertise in SA in its area of research, to provide a link between industry and academia, and to provide postgraduate training in such a form that its graduates make a real contribution to SA industry.

CURRENT RESEARCH FOCUS

Computational solid mechanics and fluid dynamics

- Dynamic deformation of metals
- Hot rolling of aluminium
- Process modelling
- Single-crystal and polycrystalline plasticity
- Strain-induced crystallisation of polymers

Biomechanics

- Biomimetics of turtle shells
- Blood flow and clotting in disease
- Behaviour of bone at intermediate strain rates
- Multi-physics modelling of glaucoma

Finite element and related methods

- Discontinuous Galerkin method
- Virtual element approaches in nonlinear elasticity

RESEARCH COLLABORATORS

- BISRU, Centre for Materials Engineering and Centre for Minerals Research (UCT)
- Cardiovascular Research Unit (UCT Medical School)
- Glasgow University (UK)
- Hulamin
- Universities of Munich/Erlangen-Nuremberg/Hanover (Germany)
- Universities of Pretoria, Stellenbosch and Witwatersrand
- University College London
- UCT Medical School (Human Biology, Medicine, Surgery)

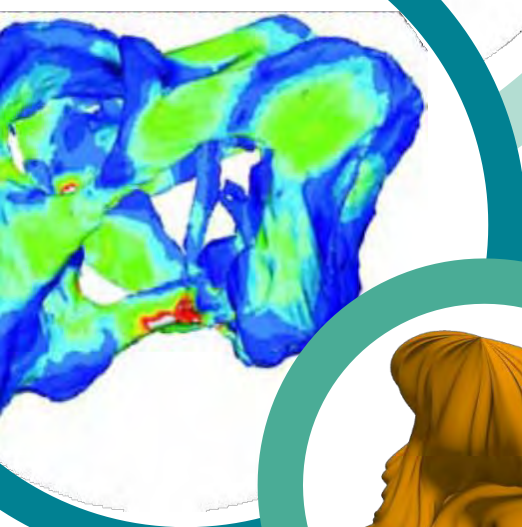
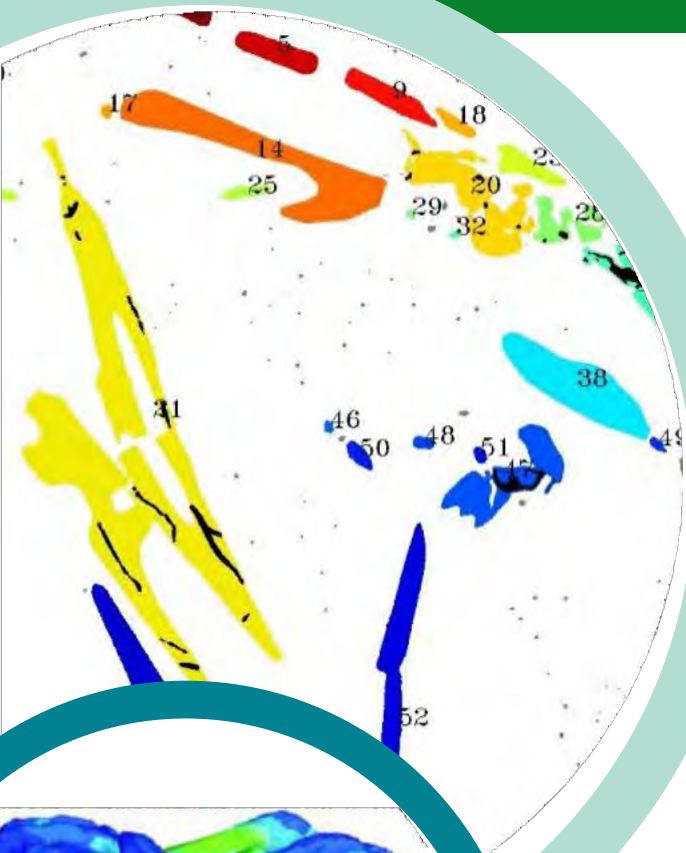
RECENT PUBLICATIONS

van Huyssteen D and Reddy BD, **A virtual element method for isotropic hyperelasticity**. Computer Methods in Applied Mechanics and Engineering 367 (2020) 113134

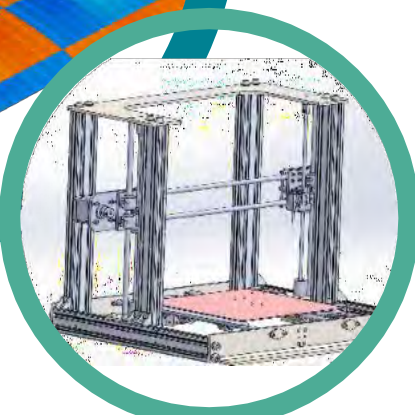
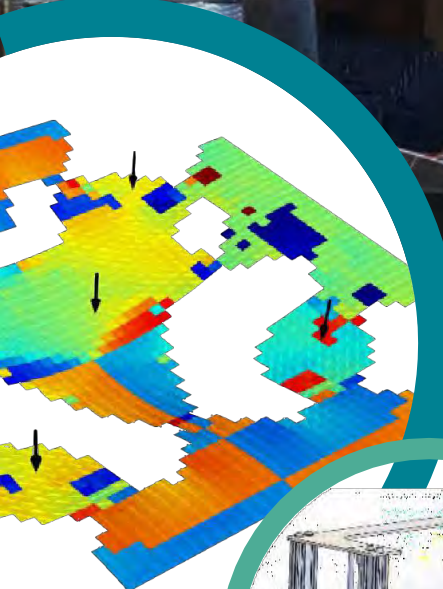
T. Ngwenya, D. Grundlingh and M.N. Ngoepe. **Influence of vortical structures on fibrin clot formation in cerebral aneurysms: a two-dimensional computational study**. Journal of Biomechanics 165 (2024) 111994

CONTACT DETAILS

Website: www.cerecam.uct.ac.za Email: cerecam@uct.ac.za



Composite Materials Laboratory and 3-D Printing



WHO WE ARE

Chris von Klemperer <i>A/Professor</i>	Reuben Govender <i>Senior Lecturer</i>	Sherlyn Gabriel <i>Senior Lecturer</i>	Sa-aadat Parker <i>Senior Lecturer</i>	Shivasi Mashau <i>Lecturer</i>	James Dicks <i>Lecturer</i>
Liquid resin moulding Mouldless FRP manufacture, FDM 3D Printing	Impact loading Biological Materials Composites 3D Printing	Composite Sustainability Blast Response	Composites Optimisation	Blast Response Composites Numerical Modelling	Biodegradable polymers Foams from vegetable oils

WHAT WE DO

The Composites Laboratory initiates research on all aspects of the manufacture, processing and optimisation of composite materials. Specialised test specimens for use in non-destructive testing research and blast impact evaluation are created and the resulting damage and test results are analysed.

Research within the laboratory also focuses on optimising composite materials processing, including using vacuum infusion manufacture to make composite components with a particular focus on low cost and Mouldless Manufacture of FRP composite structures.

3D Printing research focuses on the manufacture of 3D printed polymeric structures and designs as well as the development of 3D Printers and materials.

CURRENT RESEARCH FOCUS

- Blast response of composite materials and structures.
- Mouldless manufacture and low cost FRP manufacturing
- Numerical optimisation of composite laminate structures
- Continuous Fibre Reinforced Polymer 3-D Printing
- Embedded 3D Printing with liquid and gel inks and resins
- Manufacturing and characterisation of sustainable composites

SAMPLE PUBLICATIONS

- Sherlyn Gabriel, Genevieve S Langdon, Christopher J von Klemperer and Steeve Chung Kim Yuen. Blast behaviour of fibre reinforced polymers containing sustainable constituents. *Journal of Reinforced Plastics and Composites* 2022, pp.1–20
- Govender, R.A., Langdon, G.S., Nurick, G.N. and Cloete, T.J., 2013. Impact delamination testing of fibre reinforced polymers using Hopkinson pressure bars. *Engineering Fracture Mechanics*, 101, pp. 80-90.

KEY RESEARCH COLLABORATORS

- Centre for Materials Engineering - University of Cape Town
- Blast Impact Survivability Research Unit – University of Cape Town
- University of Stellenbosch (Mechanics Division)
- University of Sheffield (Department of Civil and Structural Engineering)

SPECIALISED FACILITIES

- Dedicated composites processing facility with oven and vacuum bag facilities
- CNC Router
- 20 ton press
- FDM 3D Printers.

CONTACTS

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Sa-aadat.Parker@uct.ac.za
James.Dicks@uct.ac.za

A/Prof Anita Campbell; A/Prof Bruce Kloot; A/Prof Corrinne Shaw

WHAT WE DO

Engineering Education research focuses on education scholarship that includes researching teaching and learning, curricula, and other topics that contribute to advancing the understanding of the education of engineers in undergraduate and postgraduate programmes, and in practice.

A team of researchers within the Department, who hold engineering education as their research focus, participate in a number of research projects that include research into teaching and learning practice, tutoring and mentoring systems, curriculum design and the social structure of higher education in the South African context. This work is undertaken in collaboration with local, national and international engineering education scholars.

CURRENT RESEARCH AREAS

- Understanding the role of academic literacy and language
- Pathways into and through engineering programmes in higher education
- Graduate destinations using social media platforms
- Transitions: into first year and the workplace
- Students' experiences of complementary studies in engineering education
- Workplace knowledge and learning
- Social responsibility and ethics in engineering education

KEY RESEARCH COLLABORATORS

- Centre for Research in Engineering Education (CREE), European Society for Engineering Education (SEFI), Research in Engineering Education Network (REEN) and REEN-Africa
- Institutions: University of Johannesburg, Virginia Tech (USA)


SAMPLE PUBLICATIONS

- Shaw, C.B. & Kloot, B. 2024. Engineering under oppressive regimes: exploring the role of engineers during apartheid South Africa. *European Journal of Engineering Education*, 1-19. doi: 10.1080/03043797.2024.2419399
- Ngoepe, M., Le Roux, K., Shaw, C. and Collier-Reed, B. (2022). Conceptual Tools to Inform Course Design and Teaching for Ethical Engineering Engagement for Diverse Student Populations. *Science and Engineering Ethics* 28(2).

CONTACT DETAILS

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Prof. Arnaud Malan
Professor in Mechanical
Engineering


Research Director

South African Research
Chair: Industrial CFD




**Prof. Tunde Bello-
Ochende**
Professor in Mechanical
Engineering

Thermodynamics,
renewable & complex
energy systems



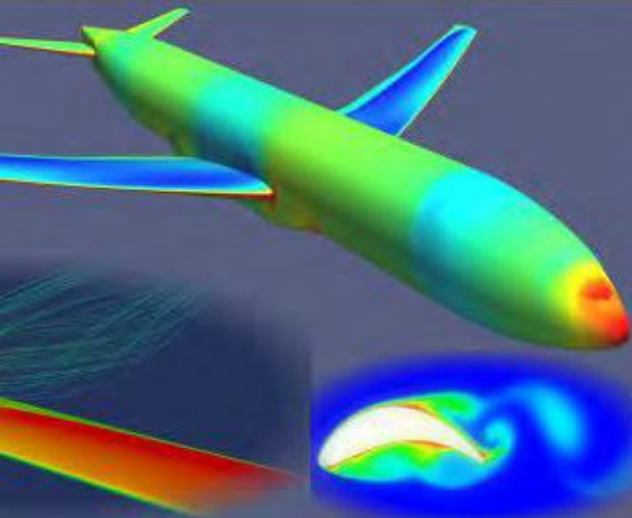
**Prof. Malebogo
Ngoepe**
Professor in
Mechanical Engineering

Computational
Biomechanics



Dr. Roy Horwitz
Honorary
Research Affiliate

Two-phase flow and
Aerodynamics



WHO WE ARE & WHAT WE DO

Computational fluid dynamics (CFD) is one of the fastest growing fields due its accuracy in designing complex systems and devices. The Industrial Computational Fluid Dynamics (InCFD) research group competes internationally in this area boasting collaborators such as Stanford University (rated no. 1 in CFD) while having established our own international award winning CFD software [Elemental Alpha Flow](#). Our research consist of further developing our software (numerical methods and programming) as well as applying our software to simulating new challenging problems for aircraft and shipping such as liquid hydrogen impact and slosh.

CURRENT RESEARCH FOCUS

- Aerospace modelling and simulation
- Liquid Hydrogen containment modelling for aircraft, spacecraft and ships.
- Higher order numerical methods for multi-phase flows

KEY RESEARCH COLLABORATORS

Centre for Turbulence Research, Stanford University
Prof. Jan Nordström, Linköping University
Airbus (UK), Airbus (Germany)
Elemental Numerics (Pty) Ltd
Prof. Stephane Zaleski, Institut Jean LeRond D'Alembert

SAMPLE PUBLICATIONS

Numerical Calculation of Slosh Dissipation,
<https://www.mdpi.com/2076-3417/12/23/12390>

CFD Based Non-Dimensional Characterization of Energy Dissipation Due to Verticle Slosh <https://www.mdpi.com/2076-3417/11/21/10401>

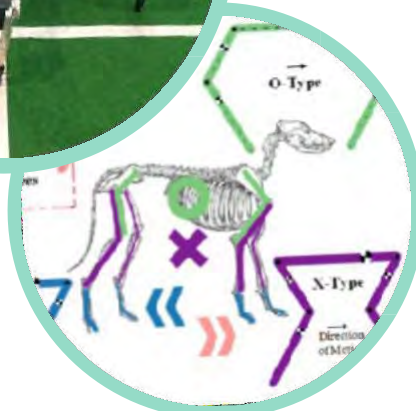
An all-Mach number HLLC based scheme for Multi-phase Flow with Surface Tension; <https://www.mdpi.com/2076-3417/11/8/3413>

A geometric VOF method for interfacial resolved phase change and conservative thermal energy advection;
<https://doi.org/10.1016/j.jcp.2020.109920>

CONTACT INFORMATION

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WHO WE ARE



Arnold Pretorius



Leanne Raw



James Hepworth



Adriaan de Villiers

WHAT WE DO

Our research group focuses on the modelling, design and realisation of complex mechatronic systems. The multivariate nature of these systems requires an intimate knowledge of integrating mechanical and electrical hardware, software and control systems into a cohesive whole.

A typical mechatronics project will involve: CAD design and simulation; software and hardware design; hardware-in-the-loop testing; and systems integration and implementation.

Our specialisations lie in mobile robotics (wheeled, legged, aerial, marine), robust control design, inertial stabilisation, and embedded systems.

SPECIALISED FACILITIES

- 3 m³ water tank for testing underwater robotic systems.
- Vision-based motion capture system.
- Electronics construction and testing equipment.
- Fully equipped experimental laboratory.

CURRENT RESEARCH FOCUS

- Limbed Robotics.
- Embedded Systems.
- Instrumentation.
- Aerial robotics.
- Robust multivariable control design.

RECENT PUBLICATIONS

- W. de Ronde, P. Bosscha, S. Marais, and A. Pretorius, 'Manufacture and testing of ARGUS: A pole climbing surveillance robot', MATECWeb Conf., vol. 406, p. 04015, 2024, doi: 10.1051/mateconf/202440604015.
- D. Schütz and J. H. Hepworth, 'uArm Swift simulation and control', MATECWeb Conf., vol. 406, p. 04014, 2024, doi: 10.1051/mateconf/202440604014.
- Z. Meyer and A. Pretorius, 'Design of a low-cost optical motion capture system using a multi-camera configuration and an asynchronous extended Kalman filter', MATECWeb Conf., vol. 406, p. 04010, 2024, doi: 10.1051/mateconf/202440604010.
- J. H. Hepworth and A. K. Mishra, "Analysis of Arctic Buoy Dynamics using the Discrete Fourier Transform and Principal Component Analysis," in 2023 IEEE International Instrumentation and Measurement Technology Conference (I2MTC), May 2023, pp. 1–6. doi: 10.1109/I2MTC53148.2023.10176076.
- A. Spirakis, J. Hepworth, and R. Verrinder, "3D Reconstruction of Pancake Sea Ice Using Lidar and Cameras," in IGARSS 2023 - 2023 IEEE International Geoscience and Remote Sensing Symposium, Jul. 2023, pp. 60–63. doi: 10.1109/IGARSS52108.2023.10282250.
- Christopher Mailer, Geoff Nitschke, and Leanne Raw. 2021. Evolving gaits for damage control in a hexapod robot. In Proceedings of the Genetic and Evolutionary Computation Conference (GECCO'21). Association for Computing Machinery, New York, NY, USA, 146–153. DOI:https://doi.org/10.1145/3449639.3459271
- Raw, L., Fisher, C. and Patel, A., 2019, November. Effects of limb morphology on transient locomotion in quadruped robots. In 2019 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) (pp. 3349–3356). IEEE.

CONTACTS Arnold.Pretorius@uct.ac.za , Leanne.Raw@uct.ac.za ,
Adriaan.deVilliers@uct.ac.za , James.Hepworth@uct.ac.za



WHO WE ARE

Coordinator

Mr Colin du Sart

Training/ Standby Coordinator

A/Prof Bruce Kloot

Administration

Beverley Glass & Carmelita Jonker

WHAT WE DO

There are more than 40 courses offered by the Department of Mechanical Engineering which require tutors.

This portfolio offers students the opportunity to tutor these courses. Roles and responsibilities typically include:

- Assisting with course administration,
- Invigilation,
- Marking,
- In person tutoring (tutorial/ practical/ hotseat),
- Online tutoring.

BENEFITS

- Competitive remuneration (hourly rates set by UCT according to student qualification/ AYOS).
- Opportunity to obtain valuable work experience through interactions with other students and the course convenors who manage tutors.
- Opportunity to contribute towards social development by helping others in need.
- General training is offered to prepare tutors for their role. However, tutors should be competent in the course content they tutor.

RECRUITMENT PROCESS

Applications

Applications open towards the end of the academic year. Students apply for courses they are interested in tutoring and are placed according to their suitability to tutor these courses and the needs of the course convenor. Regular advertisements are also posted throughout the year when additional tutors are needed.

Eligibility

Residents or foreign nationals with the right to work in South Africa are eligible. 1st and 2nd year students may not apply. Ordinarily, prospective tutors should be affiliated to UCT.

CONTACT DETAILS

colin.dusart@uct.ac.za or bruce.kloot@uct.ac.za

Postgraduate Hub

<http://www.postgradhub.uct.ac.za/>

EBE website

www.ebe.uct.ac.za

Mechanical Engineering Postgraduate programmes:

<https://ebe.uct.ac.za/department-mechanical-engineering/postgraduate-programmes>

Apply now

www.ebe.uct.ac.za/ebe/postgradstudies/apply

Funding

<https://uct.ac.za/students/fees-funding-postgraduate-degree-funding/postgraduate-degree-funding-overview>

Research Scholarships

<https://uct.ac.za/students/fees-funding-postgraduate-degree-funding-bursaries-scholarships/research-scholarships>

National Research Foundation (NRF) deadline for first-time Masters applicants – 15 June 2026

National Research Foundation (NRF) deadline for Extension funding - Masters & PhD - 3 August 2026

National Research Foundation (NRF) deadline for first-time Honours applicants - 31 October 2026

Postgraduate Administrator:

denise.botha@uct.ac.za