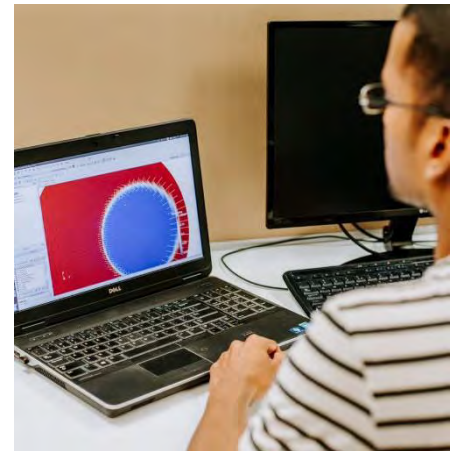
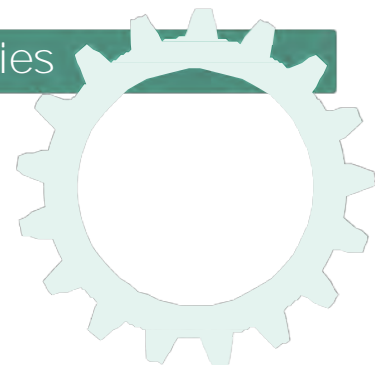


Reference Guide to
Research & Development in the Department of
Mechanical Engineering

University of Cape Town





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In 2024 we graduate students who entered our programmes after the tumultuous COVID-19 year of 2020, as well as many students who joined us at the start of 2020 and had their studies significantly impacted by moving to emergency online education. The stability to our teaching and learning spaces has returned over the past couple of years and it is easy to forget just how much determination those of you graduating this year would have had to exert to be where you are today. That determination to succeed is going to be of tremendous benefit to you as you consider your future. You have, without doubt, amazing career prospects once you complete your bachelor's degree. Many fantastic opportunities will come your way, but how can you ensure that you stand out from all the other excellent job applicants? One way to stand out is to obtain 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 whole range of transferable skills in areas of 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!).

As the Department of Mechanical Engineering at UCT we have compiled this Research Reference Guide to offer you the opportunity to look into postgraduate study.

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

Kind regards
Prof. Brandon Collier-Reed

Why Postgraduate Study?



Your journey with us, as an undergraduate student, has exposed you to the breadth of mechanical/mechanical and mechatronic engineering. The solid foundation in the various themes that you have explored has placed you on a firm footing for the next chapter of your career.

As you are well aware, we live and work in a very complex world. A postgraduate degree from our department will give you greater insight into your specific areas of interest and will give you an added edge for the competitive job market. Whether you choose to pursue a career in industry, academia or as an entrepreneur, postgraduate studies will empower you with skills and expertise that will help you make your mark wherever you go.

As you come to the end of your undergraduate degree, you may be wondering whether or not it makes sense to keep studying when you might have very enticing offers of work. I assure you that choosing to pursue a postgraduate degree will be very advantageous when you choose to enter the job market. The skills that you gain in having greater control over your own learning and research journey are transferable to the world of work.

Our department has prepared this guide for you. Take your time exploring the pages and also speak to individuals whose work interests you. Also take time to look for funding opportunities for postgraduate studies.

Wishing you all of the very best as you consider your next steps.

Malebogo Ngoepe

Postgraduate Funding

NRF POSTGRADUATE SCHOLARSHIP FOR FULL-TIME STUDIES IN 2025

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 and Doctoral: are 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 2025 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 will be available once the NRF 2025 call is open.

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

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: Six or Twelve months.

UCT INTERNAL DEADLINES FOR 2025 FUNDING:

Masters and Doctoral First-Time Applications: **19 July 2024**

Extension Support: Masters/Doctoral Applications: **15 September 2024**

Honours Applications: **30 September 2024**

IMPORTANT NOTE:

To be eligible for UCT merit and need awards, you are required to apply for these NRF scholarships. UCT will reject applications submitted after the UCT internal closing dates as indicated above.

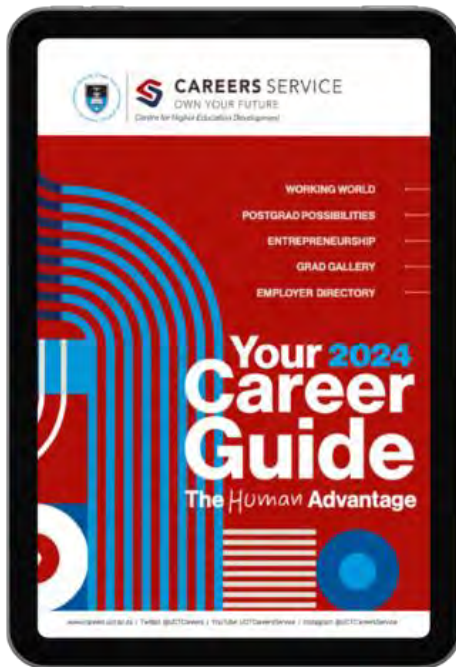
Questions? Email : nrfsupport3@uct.ac.za

Call : +27 21 650 3622

Book a consultation : bit.ly/pgfohelpdesk

Submit a service request on PeopleSoft : bit.ly/ServReqGuide


Own Your Future



Postgrad
Section

[Go to 2024 Career Guide](#)


careers.uct.ac.za

 @UCT Careers Service

mycareer.uct.ac.za

 @UCTCareers

careers.service@uct.ac.za

 @uctcareersservice

THE BENEFITS OF POSTGRADUATE STUDY

- Higher earning potential
- Enhance your employability
- Explore and acquire new skills beyond the undergraduate level to broaden your knowledge and expertise.
- Enables cross-disciplinary options
- Starting point for an academic career

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.
- Search LinkedIn for *MSc Mechanical Engineering* and select *People* to browse the profiles of graduates in jobs that interest you.



[Play Webinar](#)

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-effective way to build networks.
- Creative problem solving.
- Applying critical research and enquiry skills.
- Independent thinking and critical evaluation.
- Effective communication.
- Personal growth.
- Building professional credentials.
- Time management skills.

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.

Kamvelihle Masomelele Tabata – EBE Postgraduate Student Council Academic Chair 2022

MSc (Eng) in Structural Engineering Specialisation

WHO WE ARE

Dr. Leon Malan, Mr. Colin du 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
- Energy storage systems.
- 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

- 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 sCO₂ power cycles symposium
- 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
- Heydenrych, J.M., Rousseau, P.G and du Sart, C.F. 2023. A reduced order modelling methodology for concentrated solar power external cylindrical receivers, Proceedings of the 17th International Heat Transfer Conference, IHTC-17
- Laugsch K., Rousseau P.G. and Laubscher R., 2023, A PINN surrogate modelling methodology for steady-state integrated thermofluid systems modelling, Mathematical and Computational Applications, 28 (2)

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
- Drop testers
- DIC systems
- Composite manufacturing equipment
- Gas gun for ballistic penetration studies
- Hopkinson Bar apparatus (variable configurations including tension & compression)

SAMPLE PUBLICATIONS

- Blast behaviour of fibre reinforced polymers containing sustainable constituents, S. Gabriel, G.S. Langdon, C.J. von Klemperer, S. Chung Kim Yuen, JRPC, Vol 41(19-20), Feb 2022.
- Numerical analysis of cladding sandwich panels with tubular cores subjected to uniform blast load, W. Cheng, X.Bin, S. Chung Kim Yuen, IJE, Vol 133, November 2019.
- 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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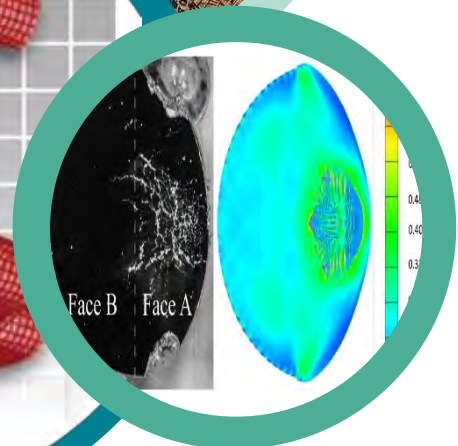
Sa-aadat.Parker@uct.ac.za

website: www.bisru.uct.ac.za

Trevor.Cloete@uct.ac.za

Shivasi.Mashau@uct.ac.za

Sheryllyn.Gabriel@uct.ac.za



WHO WE ARE



A/Prof
Thorsten
Becker



Dr
Sarah
George



James
Dicks



Dr
Sherlyn
Gabriel



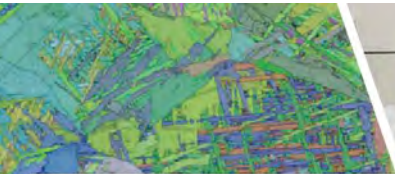
James
Hepworth



Ernesto
Ismail



Prof
Robert
Knutsen



SPECIALISED FACILITIES

- Gleeble 3800 thermo-mechanical processing simulator for the simulation of high temperature deformation processes, solidification and welding.
- Mechanical testing facilities for strength, fatigue and fracture studies.
- Weathering chamber and electrochemical instrumentation for surface studies.
- Advanced electron microscopy for microstructure characterization.

To see a list of current postgraduate projects, visit:

<http://www.mateng.uct.ac.za/mateng/people/postgraduate-students>

Contact person: thorsten.Becker@uct.ac.za

WHAT WE DO

The Centre for Materials Engineering (CME) conducts research to address pressing industry challenges while expanding the understanding of materials science. We aim to explore the relationship between processing techniques, structural characteristics, and property behaviour across diverse materials, such as metals, polymers, ceramics, and composites. CME bolsters local and global research initiatives in manufacturing process optimisation and property assessments to better align with processing and service demands. We also aim to enhance the competitiveness of South African industries by fostering their growth. Our state-of-the-art laboratory facilities facilitate advanced characterisation and property measurements, leading to widely cited publications.

Nationally esteemed and internationally recognised, CME boasts a wealth of expertise and capabilities in materials-related research. Our robust academic and technical prowess supports 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 in power plants.
- We are exploring a novel approach in the production of titanium alloy products, specifically from powder metal.
- Additive Manufacturing of titanium, nickel-based superalloy and aluminium components.
- Aluminium beverage can stock process development.
- Visualisation of material properties by high-resolution electron microscopy.
- Biodegradable polymers and foams derived from vegetable oils.

KEY RESEARCH COLLABORATORS

- ESKOM (SA)
- Hulamin (SA)
- Council for Scientific and Industrial Research (SA)
- Universities of Oxford, Glasgow, Bristol (UK)
- KU Leuven (BE), TU Delft (NL)
- CERECAM (UCT)
- BISRU (UCT)
- Stellenbosch University (SA)
- Nelson Mandela University (SA)
- Central University of Technology (SA)
- Oxford University (UK)

RECENT PUBLICATIONS

N Macallister, TH Becker, **Fatigue life estimation of additively manufactured Ti-6Al-4V: Sensitivity, scatter and defect description in Damage-tolerant models**, Acta Materialia (2022), 237, 118189
 A Koko, TH Becker, E Elmukashfi, NM Pugno, AJ Wilkinson, TJ Marrow, **HR-EBSD analysis of in situ stable crack growth at the micron scale**, Journal of the Mechanics and Physics of Solids (2023) 172, 105173.

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

Finite element and related methods

- Discontinuous Galerkin method
- Virtual element approaches in nonlinear elasticity

RESEARCH COLLABORATORS

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

RECENT PUBLICATIONS

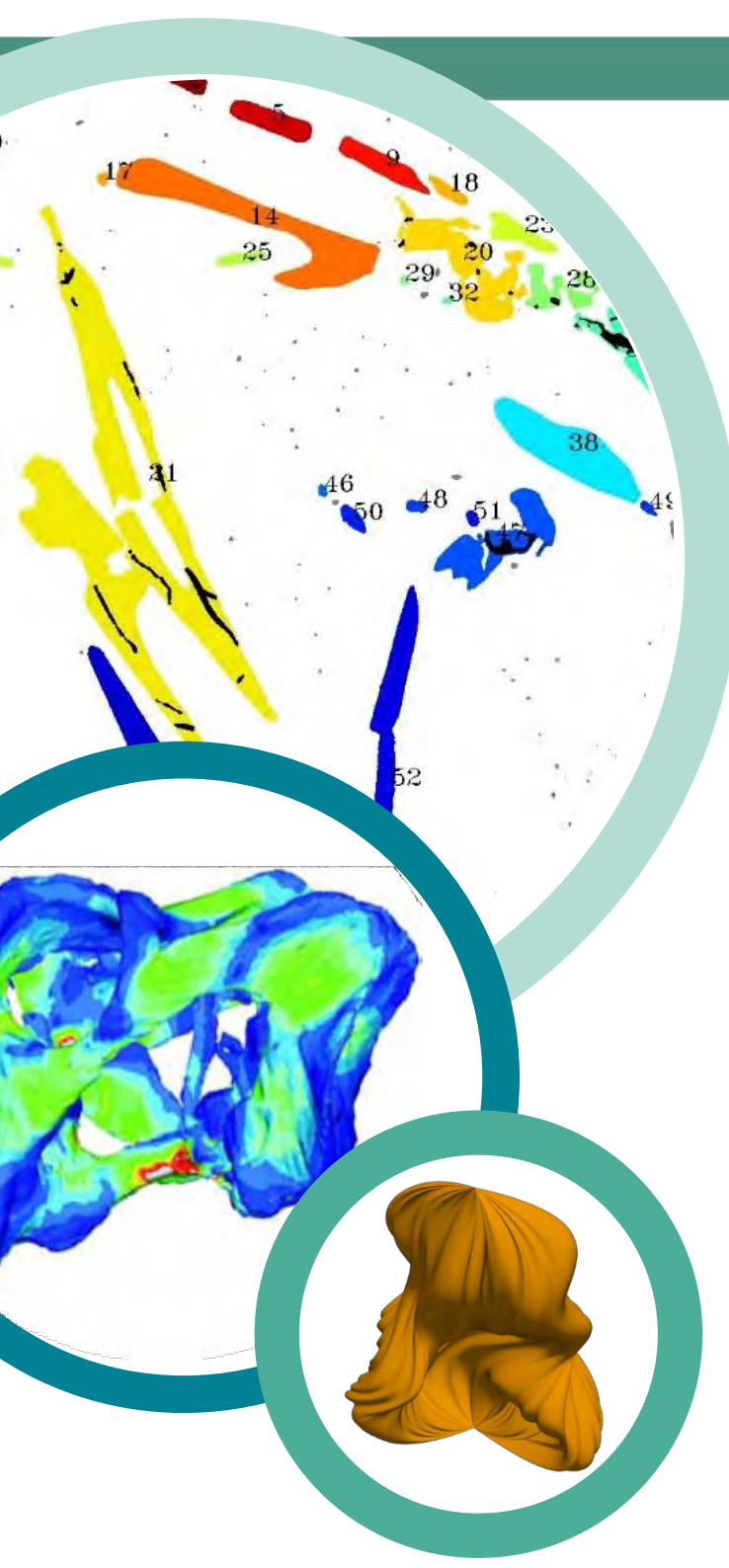
van Huyssteen D and Reddy BD, **A virtual element method for isotropic hyperelasticity**. Computer Methods in Applied Mechanics and Engineering 367 (2020) 113134

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

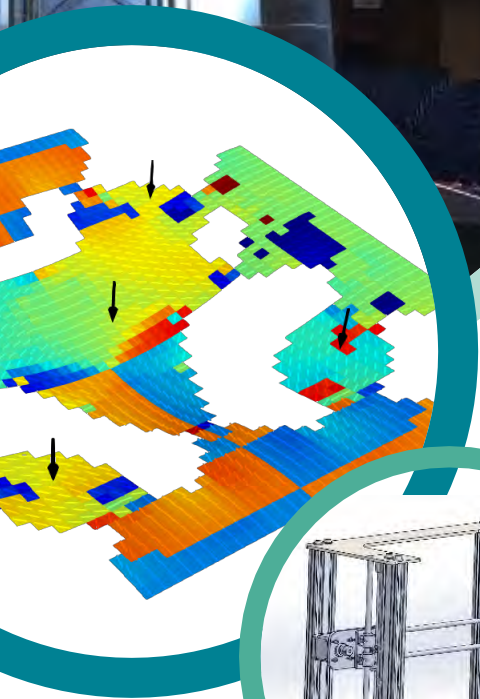
CONTACT DETAILS

Website: www.cerecam.uct.ac.za

Email: cerecam@uct.ac.za



Composite Materials Laboratory and 3-D Printing



WHO WE ARE

A/Prof. Chris von Klemperer (Liquid resin moulding methods, Mouldless manufacture, 3D Printing of Fibre reinforced Polymers)

Dr Reuben Govender (BISRU, Delamination, Fracture, Multiaxial loading, 3D printing methodologies and materials)

Dr Sherlyn Gabriel (BISRU, Blast behaviour of composite materials, Sustainability in manufacturing and materials such as natural fibres and alternative resins)

Mr Sa-aadat Parker (Numerical Optimisation, Optimum Stacking Sequence Design, Composite Material Characterisation)

Mr Shivasi Mashau (Blast response of FRP laminates and residual strength of FRPs after blast)

Mr James Dicks (CME, polymer chemistry and synthesis, sustainable materials, additive manufacturing)

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

Chris.vonKlemperer@uct.ac.za

Sherlyn.Gabriel@uct.ac.za

Shivasi.Mashau@uct.ac.za

Reuben.Govender@uct.ac.za

Sa-aadat.Parker@uct.ac.za

James.Dicks@uct.ac.za

Engineering Education

Prof Brandon Collier-Reed; 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

- Ahmed, N., Kloot, B., & Collier-Reed, B. I. (2015). Why students leave engineering and built environment programmes when they are academically eligible to continue. *European Journal of Engineering Education*, 40(2), 128-144.
- 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

Website: www.cree.uct.ac.za email: corrinne.shaw@uct.ac.za



Engineering Management

A/Prof Corrinne Shaw

WHAT WE DO

Engineering Management is unit for applied and scholarly management research. The research team undertakes projects designed to develop and grow management expertise and competence primarily in the South African engineering context. Our research work places special emphasis on the application of management theory, and systems thinking and practice to engage with complex problems in the workplace. Approaches drawn on include systems dynamics modelling and systems methodologies (among others) with the view to contributing to improvements in efficiency and effectiveness of organisations. The working organisation is the laboratory for the research projects undertaken by our postgraduate students.

CURRENT RESEARCH FOCUS

- Learning systemic management practice
- Cybernetics and organisational viability
- Applications of systems thinking in a project environment
- Operations management and lean philosophy in manufacturing
- Understanding socio-technical systems, complex systems and systems dynamics models.
- Engineering management in 4IR
- Management education and work place learning

KEY RESEARCH COLLABORATORS

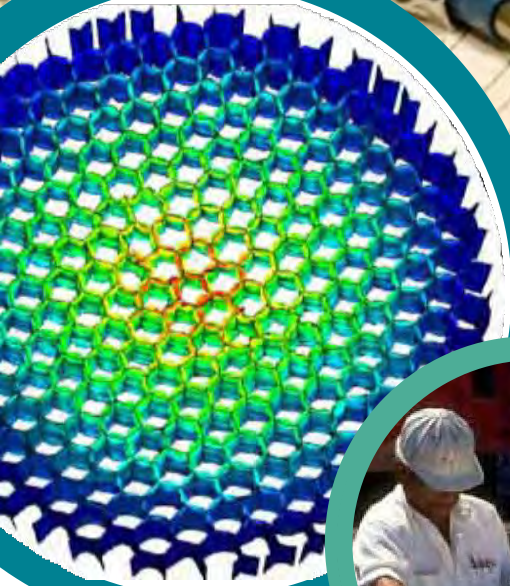
- Kalpana Ramesh Kanjee (CHED), Dr Nien-Tsu Tuan (Construction Economics and Management, UCT), Bruce Kloot, Brandon Collier-Reed, Graduate School of Business (GSB), Centre for Research in Engineering Education (CREE).
- Organisations, companies and consulting practices are the laboratory for our research projects. Postgraduate students undertaking Masters and Doctoral programmes, carry out research projects within government and commercial organisations. Typical collaborators in this management researchwork include consulting engineers, petrochemical plants and power utilities.


SAMPLE PUBLICATIONS

- Onyeagoziri OJ, Shaw C, Ryan T. (2021) A system dynamics approach for understanding community resilience to disaster risk. *Jamba*. 2021.
- Shaw C and le Roux K. (2017). From Practitioner to Researcher: Designing the Dissertation Process for Part Time Coursework Masters Students. *Syst Pract Action Res* 30, 433–446 (2017).

CONTACTS

corrinne.shaw@uct.ac.za






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



A/Prof. Malebogo
Ngoepe Senior
Lecturer in
Mechanical
Engineering

Computational
Biomechanics



Dr. Roy Horwitz
Honorary
Research Affiliate

Two-phase flow and
Aerodynamics



WHO WE ARE & WHAT WE DO

The Industrial Computational Fluid Dynamics (InCFD) research group develops state-of-the-art modelling and simulation tools for the express support of industry. This is done via the uncompromising pursuit of innovation through fundamental research which carries the hallmark of excellence. InCFD is home to the South African Research Chair (SARChI) in Industrial CFD.

CURRENT RESEARCH FOCUS

- Volume-Of-Fluid (VOF) based two-phase flow solvers for industry
- Transonic flow aerodynamics and fluid-structure interaction (FSI)
- Reduced order models for aircraft
- Structural damping in sloshing flows
- Higher order numerical methods with shifting interfaces
- Full spacecraft models: Rigid-body and fluid coupling

KEY RESEARCH COLLABORATORS

Prof. Jan Nordström, Linköping University

Airbus (UK)

Sloshing Wing Dynamics (SLOWD) (<https://slowd-project.eu/>)

Prof. Stephane Zaleski, Institut Jean Le Rond D'Alembert

SAMPLE PUBLICATIONS

Struan Hume, Jean-Marc Ilunga Tshimanga, Patrick Geoghegan, Arnaud G. Malan, Wei Hua Ho and Malebogo N. Ngoepe; Effect of Pulsatility on the Transport of Thrombin in an Idealized Cerebral Aneurysm Geometry; *Symmetry*, (2022) 14(1),133

Michael D Wright, Francesco Gambioli and Arnaud G Malan; CFD Based Non-Dimensional Characterization of Energy Dissipation Due to Verticle Slosh; *Applied Sciences*, (2021) 11(10)401

Muhammad Yusufali Oomar, Arnaud G. Malan, Bevan Jones, Roy Horwitz and Genevieve Langdon; An all-Mach number HLLC based scheme for Multi-phase Flow with Surface Tension; *Applied Sciences*, (2021) 11 (8)3413

Tomas Lundquist, Arnaud G. Malan and Jan Nordström; Stable Dynamical Adaptive Mesh Refinement; *Journal of Scientific Computing*, (2021), 86-43
Malan, L.C., Malan, A.G., Zaleski, S. and Rousseau, P.G., A geometric VOF method for interface resolved phase change and conservative thermal energy advection. *Journal of Computational Physics*, 426, p.109920. (2021)

CONTACT INFORMATION

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WHO WE ARE



Arnold Pretorius



Leanne Raw



James Hepworth

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 hardware (mechanical and electrical), 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.

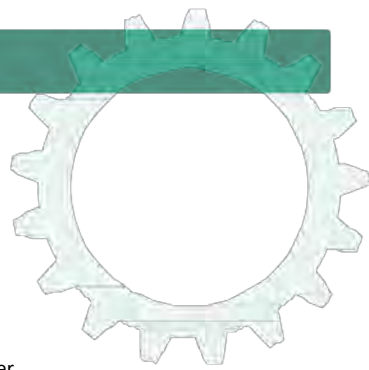
CURRENT RESEARCH FOCUS

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

RECENT PUBLICATIONS

- De Ronde, W., Bosscha, P., Marais, S., Pretorius, A. ARGUS: A pole climbing robot. RAPDASA-RobMech-PRASA-AMI Conference, 30 October – 2 November 2023
- Pretorius, A. and Boje, E., 2022. A refinement approach to the multivariable tracking error problem. *International Journal of Robust and Nonlinear Control*, 32 (12), pp.7016-7036.
- 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
- Pretorius, A. and Boje, E., 2020. A complementary quantitative feedback theory solution to the 2x2 tracking error problem. *International Journal of Robust and Nonlinear Control*, 30(16), pp.6569-6584.
- 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.

Tutoring



WHO WE ARE

Coordinator
Mr. Colin du Sart

Training/ Standby Coordinator
Dr. 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 adverts are also posted throughout the year when tutors are needed.

Eligibility

RSA residents or foreign nationals with a valid passport and visa. 1st and 2nd year students may not apply.

CONTACT DETAILS

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



Links to Important Information

Postgraduate Hub

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

EBE website

www.ebe.uct.ac.za

Mechanical Engineering Postgraduate programmes:

<https://ebe.uct.ac.za/departments/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

19 July 2024

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

30 September 2024

Postgraduate Administrator:

denise.botha@uct.ac.za