

FACULTY OF ENGINEERING AND THE BUILT ENVIRONMENT

DEAN: PROFESSOR T MAJOZI BScEng(UND) MScEng(UND) PhD (UMIST) CEng PrEng FICChemE FAAS MASSAf
FWISA FSAAE

Doctor of Philosophy

BASSON, Nicol

Mechanical, Industrial and Aeronautical

THESIS: A computational fluid dynamic study on the relief of intraocular pressure in the human eye in glaucoma surgery

The project utilises Computational Fluid Dynamic (CFD) methods to investigate two Ophthalmic surgical procedures, Trabeculectomy and Non-Penetrating Deep Sclerectomy and showed differences in the resulting flow field in the immediate post-operative state. The candidate further investigated these for biometry of European and African population groups also showing differences. The findings agree with clinical observations and suggest considerations for patient specificity in treatment considerations and provides the key first steps in developing CFD as a tool for improving ophthalmic patient outcomes.

Supervisors: Associate Professor S Williams and Associate Professor W Ho

DU TOIT, Francois Paulus

Electrical Engineering

THESIS: Modelling and optimisation of the turn-off switching transition in fast-switching power semiconductor devices

This research developed a new theoretical model using circuit theory to better understand and minimise voltage overshoots during switching transitions in fast-switching power electronic devices. The insights generated by the model provide the groundwork for overcoming the limitations imposed on switching speed due to parasitic inductance in future Ultra-Wide Bandgap semiconductors.

Supervisor: Professor I Hofsaier

EARDLEY, Matthew Peter

Mechanical, Industrial and Aeronautical

THESIS: A novel clustering approach for minimizing transportation lanes of complex supply chain networks based on economic significance

The candidate is awarded the degree of Doctor of Philosophy in Industrial Engineering for his thesis, "A novel clustering approach for minimizing transportation lanes of complex supply chain networks based on economic significance". The research introduces the Lane Elimination Clustering Problem and effectively applies a newly adapted multi-objective evolutionary approach, advancing optimisation methods in transportation management.

Supervisor: Dr J Buhrmann

FELIX, Sandra Lourenco

School of Architecture and Planning

THESIS: Desiring conscious, critical, careful practice -linking autoethnographic practice-based architectural design research with transformative pedagogy

This action research conducted in the School of Architecture and Planning at the University of the Witwatersrand adapted post-graduate autoethnographic research methods for use in undergraduate architectural design studio projects, within a parallel-engaged pedagogy of care. This proved transformative for students and teachers, producing conscious personal self-awareness and critical positioning within a post-colonial and post-Apartheid practice landscape.

Supervisor: Associate Professor A Janse van Rensburg

GAVRILOV, Zethuzonke Bella

School of Architecture and Planning

THESIS: Intersecting rationalities: Negotiating a process of inclusion between the minibus taxi Industry and the BRT system

The thesis explores negotiations between the taxi industry and the City of Ekurhuleni over BRT implementation, considering how differences and conflicts were addressed. It provides a sympathetic critique of the idea of conflicting rationalities, showing that there is more intersection and mutuality between actors than often recognised, suggesting the potential for collaborative forms of engagement.

Supervisors: Professor P Harrison and Professor A Todes

KANJEE, Janina Prakash

Civil Engineering

THESIS: Estimating the potential residual expansion due to Alkali-Silica Reaction (ASR) in in-service reinforced concrete structures

The candidate investigated the deterioration of a 78-year-old reinforced concrete railway bridge in Johannesburg affected by alkali-silica reaction (ASR), a chemical reaction that can result in the expansion of concrete. She applied a range of visual and mechanical techniques to characterise and quantify the ASR damage and established correlations between micro-scale ASR strains and conventionally measured macro-scale deformations. Her research provided insight into the performance of the ASR-affected structures, providing information on management of the ageing infrastructure to extend its service life

Supervisors: Professor Y Ballim and Associate Professor M Otieno

MOKGWARE-MONOSI, Neltah Tshepiso

School of Construction Economics and Management

THESIS: Investigation into the causes and effects of the persistence of gender norms leading to Gender Inequality in the Real Estate Industry: examining its impact on female participation in Botswana, South Africa and Zambia

This research investigated how gender norms shape female participation in the real estate industries in Botswana, South Africa, and Zambia. Employing a mixed-methods, multi-case study approach, the study finds that women's career choices are driven by ambition and opportunity; however, the persistence of structural barriers restricts women's advancement in technical and leadership roles.

Supervisors: Dr K Cheruiyot and Dr P Simbanegavi

MUKE, Pathy Musema

Mining Engineering

THESIS: A dynamic long-term and medium-term integrated open-pit mine production scheduling system based on the genetic algorithm.

Optimisation of the three interconnected (long-term, medium-term and short-term) open-pit mine production scheduling stages, requires concurrent not standalone optimisation of the stages to ensure spatial and/or temporal alignment between them. Accordingly, Pathy developed a Mixed-Integer Programming model solved using the genetic algorithm. The integrated approach generated comparable net present values but achieved 100% temporal and spatial alignment, compared to best-known feasible linear programming relaxation solutions obtained using a TopoSort heuristic algorithm. The findings were published internationally in a mining journal and conference proceedings.

Supervisors: Dr T Tholana, Professor C Musingwini and Professor M Ali

NDLOVU, Andrew

Metallurgy and Materials

THESIS: Statistical modelling of the leaching of Polycrystalline Diamond Compacts (PDCs) for integration into the product design process

This thesis optimised high-pressure high-temperature (HPHT) sintering for manufacturing polycrystalline diamond compacts (PDCs) with enhanced leachability and performance using the sintering parameters of pressure, temperature and holding time. A novel in situ pressure calibration method was developed and validated using a cubic press. The effect of thermocouple placement on temperature measurement accuracy was also studied

Supervisor: Professor L Cornish

OHENE-KWOFIE, Daniel

School of Electrical and Information Engineering

THESIS: Design, implementation and performance evaluation of an elastic partitioned global address space storage (EPGASS)

Big data has a speed bump: I/O cannot keep pace with modern processors. The candidate proposed and validated EPGASS, a revolutionary in-memory storage system using commodity hardware. EPGASS aggregates physical memories into one elastic global address space, crushing bottlenecks at teracale speeds and keeping data dancing between RAM and external disks.

Supervisors: Professor S Hazelhurst and Dr E Otoo

PIETRA, Francesco

Mechanical, Industrial and Aeronautical

THESIS: Evaluation of the relationships between measured archery bow performance and archer sensations

In the sport of archery, the complex interaction between the archer and the bow is of fundamental importance to guarantee performance. Unfortunately, there is no literature to support archers in selecting their bows. In this thesis, a mixed research methodology is utilised to evaluate the relationships between the performance, the design and the athletes' sensations in using archery equipment. This thesis describes how the methodological approach was tested and refined as it was applied to investigations of increasing complexity.

Supervisors: Associate Professor R Reid and Associate Professor P Loveday

RAMLUCKUN, Rajesh

Chemical Engineering

THESIS: BRICS (original 5) Policy Outlook, Transitional Electricity Production Technologies, Social Impact and Funding Models

This thesis investigates the Just Energy Transition within the BRICS countries (Brazil, Russia, India, China, and South Africa), with a particular focus on energy policy, technological innovations, social impact, and green finance. Using a comparative case study approach, the thesis highlights the lessons learned from BRICS countries' experiences in implementing just energy transitions, focusing on best practices and challenges faced. Special attention and recommendations have been given to South Africa, where energy poverty, socio-economic inequalities, and dependence on coal have created significant barriers to a just transition

Supervisors: Dr N Malumbazo and Dr L Ngubevana

ROSEN, Benjamin

Electrical Engineering

THESIS: Information-Theoretic clustering techniques for correlated sources in network content caching

This research tackles the complexity of managing correlated sources of internet data. It develops efficient information-theoretic clustering algorithms to simplify and efficiently manage network content caching. These algorithms offer near-optimal results with predictable performance, which is crucial for reducing network traffic and making the system more practical.

Supervisor: Professor L Cheng

SMITH, Janet

School of Chemical and Metallurgical Engineering

THESIS: Bioremediation of Acid Mine Drainage Using Grass

This research investigates a sustainable biological method to treat acid mine drainage (AMD) from South African coal mines, using co-located grasses and naturally occurring sulfate-reducing bacteria. Waste grass is used to produce clean water from AMD, supporting a circular economy and helping tackle South Africa's water, energy, and food challenges

Supervisors: Associate Professor L Van Dyk, Associate Professor K Harding and Professor C Sheridan

TAKALANI, Rofhiwa Lutendo Edward

Electrical Engineering

THESIS: Development of energy management strategies for Port Cranes

This research developed an optimal energy management system for port cranes to reduce electricity consumption, recycle braking energy, and enhance efficiency. By combining batteries and supercapacitors and utilising optimised control methods, the system reduces the power drawn from the grid, making crane operations faster, greener, and more cost-effective, thereby supporting future renewable energy use at ports.

Supervisor: Associate Professor L Masisi