

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

ALADE, Jimmy Joanah

School of Chemical and Metallurgical Engineering

THESIS: Optimization of the mineral grading wind sifter separator for coal beneficiation

A novel dry coal separator with potential for beneficiating other minerals was designed and fabricated using the concept of wind-sifting, which is used in wood, food, and waste separation processes. The separator was designed based on the Lagrangian particle tracking method, along with the data obtained from simulation tests performed for different particle sizes at different airstream velocities. According to the data obtained from the pilot test, clean coal products of different qualities were obtained for various applications.

Supervisor: Dr S Bada

DOERMANN, Kirsten

School of Architecture and Planning

THESIS: Urban Compounds: Investigating aspects of rapid urbanisation and densification in

Sub-Saharan Africa and the effect on the physical morphology of selected suburbs in Johannesburg

The candidate's thesis is a remarkable architectural practice-led research project which investigates the quite recently emerging "compound" housing based on the widespread Edwardian bungalows across various parts of the early urban expansion of Johannesburg. The study investigates re-adaptation and the flexibility of the typology in detail, both physically, economically, socially and culturally and uncovers a vibrant housing sub-market that defies city ideals of urbanism yet delivers city objectives of densification, mixed use, economic growth and transformation. As such, it paves the way for further research on its subject - and also the wider use of practice-led methodologies of architecture research in South Africa.

Supervisor: Professor P Jenkins

FADELE, Oluwadamilola Adepeju

School of Civil and Environmental Engineering

THESIS: Assessment of the performance of corn cob ash as a partial replacement for Portland cement in concrete

While contributing to reducing the negative environmental impact of concrete, the use of corn cob ash as a partial replacement for Portland cement was found to not only have a negative impact the strength of concrete but also increased the risk of alkali-silica reaction.

Supervisor: Professor M Otieno

GOVENDER, Neil

School of Construction Economics and Management

THESIS: Determinants of professional service output quality in the construction industry

To address the causes of the decline in quality of documents produced by built environment professionals, the candidate systematically investigated the factors influencing professional service quality in construction, and the extent to which the quality of documents produced by construction professionals is specifically determined by the amount of fees.

Supervisors: Professor S Laryea and Professor R Watermeyer

IKPESU, Jasper Ejowwokoghene

School of Chemical and Metallurgical Engineering

THESIS: Performance evaluation of reduced graphene oxide incorporated dye-sensitized solar cells for stable power generation

In this study, performance evaluation of reduced graphene oxide incorporated dye-sensitized solar cells (DSSC) for stable power generation has been investigated. Titanium dioxide-reduced Graphene Oxide (TiO₂-rGO) composite was synthesized at the photoanode, and inserted into DSSCs. The power conversion efficiency of DSSCs improved cell performance and outdoor stability from 2.75 - 11.52%. Confirming TiO₂ - rGO as a good material for solar application.

Supervisors: Professor M Daramola and Professor S Iyuke

MADAHANA, Milka Cynthia Ijunga

School of Electrical and Information Engineering

THESIS: Port Hamiltonian modelling of an integrated mechanical ventilator-human respiratory system

This research work presents a comprehensive modelling of an integrated mechanical ventilator-human respiratory system using an energy-based technique known as Port Hamiltonian. The application of the technique results in the extension of the modelling approach to include the effects of fluid flow using incompressible Navier Stokes equations, resulting in a multi physics generalized Port Hamiltonian model. This model can be used to investigate the influence of airway secretion on airflow dynamics in the mechanical-human respiratory system.

Supervisor: Dr O Nyandoro

MAHBOOB, Muhammad Ahsan

School of Mining Engineering

THESIS: A data science framework for mineral resource exploration and estimation using remote sensing and machine learning

This research innovatively combines data science, satellite imagery, and machine learning to revolutionize mineral exploration. By swiftly identifying prospective mineral-rich sites, especially in remote areas, it accelerates critical mineral extraction. This contributes significantly to green technology production, advancing global sustainability and climate change mitigation.

Supervisors: Professor T Celik and Professor B Genc

MANDA, Tamala Amelia

School of Construction Economics and Management

THESIS: Intrinsic valuation of REITs

In order to ascertain the intrinsic value of Real Estate Investment Trusts ("REITs") and comprehend their financial standing, the candidate examined the beta profiles, bankruptcy forecasts, and dynamic cash flows of REITs.

Supervisor: Dr T Sebehela

MCDONALD, André Martin

School of Electrical and Information Engineering

THESIS: Constrained solutions to IFPP's by finite-dimensional approximation

Radar and communications systems must adhere to strict performance specifications under a range of probabilistic situations. For engineering certification purposes, current test and evaluation procedures necessarily required costly extended field trials. This research developed novel solution methodologies to the foundational inverse Frobenius-Perron problem in abstract ergodic theory, enabling development of low-cost test infrastructure that will reduce field trials to those absolute necessary.

Supervisor: Professor A van Wyk

NGHIPULILE, Titus

School of Chemical and Metallurgical Engineering

THESIS: Modelling the comminution process in the Rotary Offset Crusher

This was initially a Master Research project on a new crusher under development, in the school, on an innovative crusher that exploits the cyclic variation in the space between two off-centre disks, hence the name, Rotary Offset Crusher (ROC). Despite an indication of great capacity potential, driving principles were not clear. The numerical particle simulation incorporated at PhD level has helped gain a better understanding of the dominant factors influencing the behaviour of this crusher.

Supervisors: Professor M Bwalya and Professor H Simonsen

SANGWENI, Nondumiso Zamangwane

School of Construction Economics and Management

THESIS: Retention of professional female talent within the construction industry

With experience and a hunger for solutions, the candidate completed a thesis on strategies to retain female talent and developed the Female Talent Retention Framework, an adaptable hybrid model for the retention of female talent in the construction industry.

Supervisor: Professor A Ozumba

SCHEKMAN, Sjouke Willem

School of Mechanical, Industrial and Aeronautical Engineering

THESIS: Internal cooling at the trailing edge of a high-pressure gas turbine blade

Gas turbine aero-engines require specialized cooling techniques due to extremely high operating temperatures, as high as 2000 °C. The candidate's research considered a specific cooling technique that combines perforated blockages and cylindrical short pin-fin structures. This configuration was previously considered to be ineffective and discounted from future consideration. However, the candidate hypothesized and then verified that this cooling technique had been originally misrepresented. Based on the results of the candidate's PhD thesis, this specific cooling technique can be now seen to be a viable alternative for gas turbine aero-engine cooling.

Supervisor: Professor T Kim

SIWAWA, Vincent

School of Civil and Environmental Engineering

THESIS: A bottom-up smart city approach to solid waste management: the case of ICT - enabled waste reclaimers system in two South African cities

The candidate submitted a thesis on waste reclaimers in Johannesburg and Cape Town. The study draws on the socio-technical transition theory to sustainability and the Multi-Level Perspective as conceptual frameworks to analyse the digital transformation of the informal waste sector. His findings underscore the potential of the ICT-enabled system to foster symbiotic connections between stakeholders.

Supervisor: Professor A Fitchett

TEIMOURI, Samaneh

School of Chemical and Metallurgical Engineering

THESIS: Hydrometallurgical extraction of metals from secondary resources using various reagents

The candidate explored new and novel extraction methods to obtain scarce and critical metals from secondary resources. Gold encapsulate in pyrite in old mine tailings require a breakdown of the pyrite material to release it for recovery. This was one of the aspects investigated in this thesis, and new insights were gained into the process via electrochemical studies. Another area of interest was the recovery of gallium and indium, two metals of great value in the electronic industry, from waste electrical arc furnace dust, a waste generated by the steel industry. This was accomplished through a theoretical modelling approach and novel ionic liquid extraction.

Supervisors: Professor C Billing and Professor J Potgieter