The Department of Mechanical and Industrial Engineering

Newsletter First Edition

UNISA university of south africa

Message from the editorial team

The editorial team is proud to publish the first DMIE annual magazine. This will be a continuous journey of improving and learning and we are looking forward to your inputs, suggestions and critique with a view of refining the quality of the magazine year on year.

Please feel free to give feedback on the current version and what we need to do to improve our future versions to the editorial team:

Rabelani Murwamadala
Nthabiseng Jane Ramanamane
Tetelo Lekwana
Zahra Shaikh
Nelsiwe Nkambule
Kgabo Mokgohloa

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Message from the COD

As a Department, we have travelled far and wide in the pursuit of knowledge and understanding Science. We have done more in ensuring that we connect with the world.

The importance of this connection was and is to ensure that we are on par with the top mates in the class. Our work can be checked by those who are knowledgeable and experienced. As a Department, we have visited and made connections with top universities like Ghent University, Massachusetts University, VIT and VelTech. We make sure that our work is not only known in the house but also outside the neighbourhood.

The Mini Baja team completion was one of the ways in which we have shown ourselves to the world to ensure that we are registered not only as theoretical engineers but also as engineers who can design, build and test. This activity has gone a long way since last year and our Mini Baja team has become number one amongst the best. Again, this shows that if we put all our energy in our endeavours, we can indeed succeed.

Our staff members have continued to publish their research in reputable and well-placed international journals with high impact factors. We now have one of the best research and teaching facilities in South African and arguably the world. We need to press hard in ensuring that these facilities are used to the benefit of our students and Unisa in general. I believe that the only way to move forward and to be recognised will be to pull those who are still at the bottom up with us. It is with pleasure that I can announce that as a Department, the majority of our staff members are now registered for higher degrees.

You cannot solve a problem if the problem is not properly diagnosed, and as a Department, we have talked and clearly diagnose the challenges we face. The positive outcome is that we have been able to also provide medicine for the majority of these problems. We have worked together to ensure that we contribute to quality engineering programmes and we have come up with various interventions that will enable us to immediately and gradually improve our knowledge.

Prof F Nemavhola

Dr Ndou's PhD journey

"When I was young, I would take things apart just so that I could put them back together again."

I grew up like any other child in the village of Tsianda, Venda, in Limpopo, looking after cattle. Like many children at the time, we would sometimes come home from school and not have anything to eat. This encouraged me to want more in life. My goal was to be successful despite my circumstances. I decided that my circumstances were not going to define me, nor determine my future.

In the world of engineering, you discover new things; it allows you to be creative and inspires you to want to learn more. When I was young, I would take things apart just so that I could put them back together again. Completing my PhD was important to me, because in the current environment, it is an entry level to research. A PhD in Engineering gives one an edge as it is not an easy degree to achieve and it also opens the doors to the world of research and allows one the opportunity to specialise in a chosen area of research. To juggle my part-time studies, a full-time job and my family was not easy. I had to sacrifice a lot of family time, work at night and sometimes go away to attend conferences while leaving my family behind. It required discipline and I had to remain focused on my work and the goal I had set out to achieve. My thesis was on surface engineering: laser metal deposition of titanium alloy grade 5 and tungsten.

Because of my area of research, my focus changed from an undergraduate qualification in Industrial Engineering to Mechanical Engineering. I am currently involved in Unisa's community engagement project, Applications for Sustainable Technology in Rural Africa (ASTRA), to help high school learners from Grades 8 to 11 to identify research problems, to find information related to research problems and to summarise and write PowerPoint presentations. I am also involved in Rural Engineers, a programme that inspires young learners in rural secondary schools who are taking Science and Mathematics as subjects.

We give career guidance to all grades and inspire learners to be motivated in their studies to ensure successful futures. I have learnt that you need to set goals for yourself, that you must always keep your goals in mind and work hard towards achieving them because if you don't, your chances of achieving them eventually are extremely slim. I have also found that it is very important to network with peers in one's field as it facilitates the acquisition of knowledge and information about one's research topic.

By Nelsiwe Nkambule

Citations for our students

Biography of
Mrs Sandhya Devireddy

Department of Mechanical and Industrial Engineering University of South Africa
Florida Science Campus, Johannesburg
dsandhya2007@gamil.com

Sandhya Devireddy is a PhD scholar of Unisa working in the area of nano-fluids and heat exchangers under the supervision of Prof Veeredhi Vasudeva Rao of the Department of Mechanical and Industrial Engineering. She holds two masters degrees: a MTech with specialisation in nano-technology from JNT University, Hyderabad and a MSc degree with specialisation in Physics from Osmania University, Hyderabad.

She was at the top of her class during her MTech degree program and was awarded a gold medal for best performance. She also received an industry scholarship from the R&D division of Candor Paints Manufacturing Company and worked as an assistant professor from 2008 to 2017 at different engineering colleges in India. She published several research papers and participated in peer-reviewed international conference proceedings. She also co-authored a book, Biophysics of insect flight.

Laboratories

The evolving technology throughout the world has put South African firms under severe pressure to remain competitive and to sustain global competitiveness through price, quality, speed and availability. Hence, Unisa periodically meets with the industrial sector to discuss the specific industrial challenges and their needs, giving priority to suitable engineering skills. It is for this reason that Unisa has a responsibility to offer extensive training to its students in line with the DHET requirements and ECSA accreditation. To meet this goal, Unisa had injected a multimillion rand investment in building structures equipped with state-of-the-art, sophisticated and technological machinery, that are widely used in the manufacturing world.

Industrial Engineering Laboratory

Mechanical Engineering Laboratory

Programming-stations

By Nelsiwe Nkambule

Mud, Guts and Glory For Unisa Motorsport Design Teams

By Thembeka Ntuli-Mpapama and Nkululeko Mpakama

The executive dean, Prof Bhekie Mamba, and the entire College of Science, Engineering and Technology (CSET), wish to congratulate the team of engineering students and staff under the leadership of Dr Thembalani Sithebe from Unisa's Department of Mechanical and Industrial Engineering who obtained the number one spot in the Mini Baja Competition held on 26 October 2018.

The object of the competition is to simulate real-world engineering design projects and their related challenges. Each team competes to have its design accepted for manufacturing by a fictitious firm. The students must function as a team to design, engineer, build, test, promote, and compete with a vehicle within the limits of the rules. They must also generate financial support for their project and manage their educational priorities. In 2018, six cars entered, three from Unisa and three from the University of Pretoria. The number one and two overall winners were from Unisa.

The project requires students to design and build a prototype four-wheel, single-seater, off-road recreational vehicle to meet a given set of design specifications. The vehicle must be safe, easy to transport, fun to drive, and good-looking. It should also be able to negotiate rough terrain and handle anything a recreational user will most likely put it through. Apart from certain minimum safety requirements, the design is open to the initiative and ingenuity of the students. According to Sithebe, each team's goal is to design and build a single-seat, all-terrain sporting vehicle whose structure contains the driver. The vehicle must be a prototype for a reliable, maintainable, ergonomic, and economic production vehicle that serves a recreational user market, sized at approximately 4 000 units per year.

performance in terms of speed, handling, ride, and ruggedness over rough terrain and off-road conditions. The performance is measured by success in the dynamic events, which are described in the Baja SAE® rules, and are subject to event site weather and course conditions. Eligibility is limited to undergraduate and graduate students to ensure this is an engineering competition rather than a race.

Prof Fulufhelo Nemavhola, the head of the Department of Mechanical and Industrial Engineering, congratulated the team and mentioned that the importance of this project cannot be overemphasised, since it provides students with a practical way of learning directly what was taught in class. In 2018, Unisa had three vehicles and three teams. Sithebe says that the Mini Baja project is used as an alternative to work-integrated, project-based learning. The Department had 23 WIL (MCP101E & MCP201E) students enrolled in this project.

The time scales were:

- Vehicle design – three months
- The practical training, that is, welding/ fabrication, machining, use of workshop machines such as lathes, milling, CNC, and hand tools runs concurrently with the design.
- Fabrication of the vehicles – four months, or up to the competition date.
- Vehicle-specific systems, such as roll cage, braking systems, drive train, steering, driver systems, safety requirements, and general conformation to the SAE Baja rules, run concurrently with the vehicle fabrication.

The Mini Baja project also includes finance and administration (Sithebe and Sandile Khambule) and systems champions (i.e. specialists in specific systems, such as fabrication; machining/workshop general, drive train, braking system, steering system, clutch), all done by the technical staff, Johan Hanning and Christopher Baatjies.

Unisa 6

Working in the state-of-the-art engineering workshops at the Unisa Science Campus, students from the Department of Mechanical and Industrial Engineering built Unisa 6, a mini car, from scratch, to participate in the SAE Baja® competition for the first time.

The Unisa team with Unisa 6 led by Dr Thembalani Sithebe, the team members: Bruce Ian Dutton, Ndishavhelafhi Ralinala, Queen Ndimande, Luan Badenhorst, Lebogang Clerrence Lebea, Busisiwe Sibongile Ndlazi, Yelaphi Ncube and Nyikane Abner Khoza

Apart from certain minimum safety requirements, the design is open to the initiative and ingenuity of the students. The Unisa team managed to design and build a beautiful prototype which adhered to the specifications. The team went through all the stages of the competition but was unable to take part in the endurance race due to safety inspection issues.

The action-packed annual national competition, held in October each year, forms the culmination of nine month's hard work by the students from the various tertiary institutions. The final competition consists of four parts, namely safety judging, design evaluation, performance testing, and a four-hour endurance race aimed at pushing the vehicles to the limits of their durability.

Other institutions that were present were three local universities, Tshwane University of Technology, the University of Pretoria, and the University of South Africa. All these universities experienced technical challenges. Unisa's challenge was a safety measure on the brake system, after which the inspectors deferred Unisa's participation in the race to the national competition in October 2019. The winners will join the international race in Canada!

The objective of the SAE Baja® competition is to expose tertiary students to the planning, design and manufacture of a real-world engineering project. This equips them with the required skills necessary for real world engineering. The SAE Baja® competition originated at the University of South Carolina in the United States in 1976, under the supervision of Dr JF Stevens. It is currently administrated by the Society of Automotive Engineers (SAE). Locally, the SAE Baja® competition was initiated in 1996 by Barry Grobbelaar and Francois Naudé from the Department of Mechanical and Aeronautical Engineering at the University of Pretoria.

Unisa's team and Prof Wei Hua Ho (CoD: Mechanical and Industrial Engineering) inspecting Unisa 6

Inauguration of scholars to the Academy of Science of South Africa – Prof Nemavhola makes the cut

Twenty of the country's leading scholars and scientists were inaugurated as Members of the Academy of Science of South Africa (ASSAf) at the annual awards ceremony on 10 October 2018.

As the official academy in South Africa, ASSAf's core function is to honour the country's most outstanding scholars by electing them to membership of the Academy. ASSAf members are drawn from the full spectrum of disciplines.

New members are elected each year by the full existing membership. Membership of the Academy is a great honour and is in recognition of scholarly achievement. Members are the core asset of the Academy and give of their time and expertise voluntarily in the service of society.

The 20 new ASSAf members bring the total membership of ASSAf to 559.

At the same time, ten new members of the South African Young Academy of Science (SAYAS) were inaugurated.

SAYAS was launched in October 2011 as a means to enable South Africa's young scientists to fully participate in local and internationally relevant research and development agendas.

It provides a national platform where leading young scientists from all disciplines in the country can interact, and also access international networking and career development opportunities.

SAYAS members are young scientists below the age of 40, they have PhDs and are deemed excellent in their fields of expertise. SAYAS members come from all disciplines including pure and applied sciences, humanities, social sciences and the arts.

The new ASSAf members are:

Prof Montaz Ali, a professor in the School of Computer Science and Applied Mathematics, University of the Witwatersrand (Wits).

Prof Lyn-Marie Birkholtz, professor in Biochemistry at the University of Pretoria (UP) and she holds a Department of Science and Technology/National Research Foundation (DST/NRF) South African Research Chair in Sustainable Malaria Control at the same institution.

Prof Juanita Bornman, professor as well as director of the Centre for Augmentative and Alternative Communication at UP.

Prof Daniel Bradlow holds the DST/NRF South African Research Chair in International Development Law and African Economic Relations at UP.

Prof Basil Brooke, Head: Vector Control Reference Laboratory at the National Institute for Communicable Diseases and professor at the Research Institute for Malaria, Wits.

Prof Kelly Chibale, a professor of Organic Chemistry at the University of Cape Town (UCT) and a full member of the UCT Institute of Infectious Disease and Molecular Medicine.

Prof Margaret Chitiga-Mabugu, the director of the School of Public Management and Administration, UP.

Prof Mark Cotton, the director of the Children's Infectious Diseases Clinical Research Unit at the Faculty of Medicine and Health Sciences and the Tygerberg Children's Hospital.

Prof Michael Davies-Coleman, professor emeritus and dean of Natural Sciences and professor of Chemistry, University of the Western Cape.

Prof Erika de Wet holds the DST/NRF South African Research Chair in International Constitutional Law in the Faculty of Law, UP.

Prof Rangan Gupta, a professor at the Department of Economics, University of Pretoria.

Inauguration of scholars to the Academy of Science of South Africa – Prof Nemavhola makes the cut

Prof Chaudry Khalique, professor of Applied Mathematics at North-West University.

Prof Lise Korsten, the co-director in the DST Centre of Excellence Food Security. She is also the head of Plant Pathology in the Department of Plant and Soil Science at UP.

Prof Helena Kuivaniemi, professor in the Division of Molecular Biology and Human Genetics, Department of Biomedical Sciences, Stellenbosch University (SU).

Prof Virna Leaner, professor in the Division of Medical Biochemistry, Faculty of Health Sciences, UCT.

Prof Kevin Naidoo holds the DST/NRF South African Research Chair in Scientific Computing and is the director of the Scientific Computing Research Unit, Chemistry Department, UCT.

Prof Jan Neels, a distinguished professor of International Commercial Law, University of Johannesburg (UJ).

Prof Charles Ngwena, professor at the Centre for Human Rights, Faculty of Law, UP.

Prof João Rodrigues, head of the Wits School of Physics and director of the Centre for Theoretical Physics at the same institution.

Prof Marissa Rollnick, professor emeritus at the Wits School of Education.

The ten new SAYAS members are:

Dr Fanelwa Ajayi, a senior lecturer at the Chemistry Department and a research leader at the Enzyme Sensor Laboratory, SensorLab, at the University of the Western Cape.

Dr Tatenda Dalu, a senior lecturer in the Department of Ecology and Resource Management at the University of Venda.

Dr Sarah Fawcett, a lecturer in the Department of Oceanography at UCT.

CellScale user publication highlight: prediction of hyperelastic material properties of fuel cell membranes

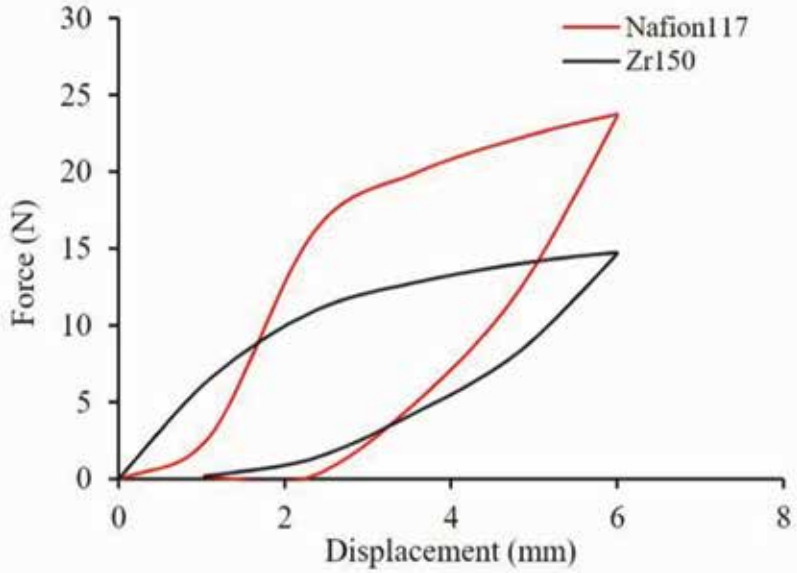


Figure 2. Force-displacement loading and unloading curve in the uniaxial direction of Nafion117 and Nafion®/ ZrO_2 nano-composite membrane

Proton-exchange membrane fuel cells are a favourable alternative to the internal combustion engines in vehicle applications. It was initially developed by General Electric for NASA for use in the Gemini spacecraft (ScienceDirect). In this system, thin, conductive membranes are used to transport protons from the electrolyte to the cathode. Commercial membranes such as Polymer Nafion® are available, although challenges are present to develop optical mechanical/ conductive properties for their function as well as determining the appropriate law to characterise their material properties from a vast number of material models.

Drs Fulufhelo Nemavhola and RA Sigwadi from the University of South Africa have written in this study a comprehensive review of six hyperplastic material models on two types of membranes – commercial Nafion®117 and one treated with zirconium oxide. Uniaxial tensile tests of up to 40% strain were conducted using the CellScale UStretch to gather force and displacement data in order to calculate stress and strain. They were then input into each material model to calculate the materials constants. The team further performed an error analysis between experiment and fitted data, concluding that one particular model has exhibited best fit properties and could thus be used to describe the mechanical properties of the membrane.

The figure above shows the force and displacement curves of the two membranes studied. We can observe that the relative strength of Nafion®117 is higher than the modified version at a given displacement. In future research, the team at the University of South Africa will focus on the fatigue properties of Polymer Nafion®.

Read the full journal article here: *http://journal.ump.edu.my/ijame/article/view/339*
Read about Prof Nemavhola's research here: *https://www.unisa.ac.za/sites/corporate/default/Colleges/Science,-Engineering-&-Technology/Schools,-departments-&-centre/School-of-Engineering/Department-of-Mechanical-and-Industrial-Engineering/Staff-members/Mr-F-Masithulela*

By Alexandra Hoon | 25 July 2019 | In The Lab

UNISA and MINTEK launch a state-of-the-art 3D imaging facility

Prof Nemavhola, Dr Katumba and Prof Mamba with MINTEK colleagues

Mintek and Unisa's College of Science, Engineering and Technology (CSET) are proud to announce their joint acquisition of a state-of-the-art 3D X-ray microscopy system. 3D X-ray imaging of advanced materials, rocks and minerals facilitates the ability to "see what is inside" without physically breaking down the sample. The instrument, which produces images similar to those from a CT scan that is used for imaging the human body, can be used to assess different materials.

Many benefits are anticipated from the insights offered by 3D imaging. "For Unisa, it will be important for research into advanced materials such as ferrous metals, non-ferrous metals and new materials" said Prof Fulufhelo Nemavhola, head of the Department of Mechanical and Industrial Engineering, which hosts the instrument. "For Mintek, the instrument additionally visualises rocks and their processed products in 3D, to relate mineral characteristics directly to their behaviour during different stages of beneficiation" added Dr Deshenthree Chetty, technical specialist in the Mineralogy Division at Mintek.

"As part of Mintek's strategy to strengthen collaborative research with local universities, we are excited by this opportunity to build and contribute to human capital development, through our joint research capabilities," remarked Dr Makhapa Makhafola, the general manager for Research and Development at Mintek. Prof Mamba, executive dean of CSET at Unisa, concurred: "This is a milestone in our research endeavours, as we push our research agenda to benefit citizens directly. We are pleased to have Mintek on board".

The instrument was launched at Unisa's Science Campus in Florida on 24 July 2018 and attracted more than 60 guests to view the new acquisition.

At the launch, a Mintek board member commented that valuable data will be generated from the instrument, which will help in ensuring that solutions are provided to the challenges facing the mining industry. She further mentioned that in light of the fact that resources in the country are limited and funding is shrinking, collaboration between researchers remains of critical importance and that competition should be discouraged at all levels to give impetus to emerging ideas.

Ms Nosiphiwo Mzamo, manager of the Mineralogy Division, gave a short overview of Mintek's research to date in the field of X-ray tomography and the benefits of technology to unlock mineral wealth in order to obtain shorter time-to-benefit for beneficiating our ore deposits, thus reiterating Mintek's commitment to provide solutions to the mining industry through collaborative research.

In his opening remarks, an excited Prof Mamba mentioned that Unisa prides itself on the solutions it provides to many of the country's challenges. Studying engineering at a distance is considered a challenge by many but not at Unisa. He added that there is a tendency among South African universities to collaborate with international universities and to neglect our own local industries. He is of the opinion that such behaviour needs to end. Professor Mamba also emphasised that Unisa is delighted about the acquisition of the state-of- the-art 3D X-ray microscopy system and mentioned that at Unisa, there is no researcher who owns an instrument, meaning that this facility will be accessible to all researchers, learners, industries and even potential partners.

Dr Katumba, the deputy executive dean, encouraged the two institutions and stated that collaboration with the industry is crucial and that it plays a major role in ensuring the functionality of institutions of

higher learning. The Science Campus offers advanced laboratories and high- end equipment, thereby advancing science education and research at a national level. The laboratories are for teaching and learning, as well as research purposes. The modern facilities and equipment not only enable the training of both undergraduate and postgraduate students, but also attract international scholars and researchers to the campus to do research or participate in collaborative research activities. The Science Campus creates an environment that truly stimulates research and innovation, supports researchers and scientists, and meets the educational and training needs of Unisa's distance learning students, at both undergraduate and postgraduate levels.

After the ribbon-cutting ceremony, guests were able to view the instrument and the 3D images generated to date. Explanations were given on how the information impacts on research into weld failure, and the understanding of platinum group mineral distribution in ores, as examples of current projects from both institutions.

The facility strengthens the relationship between the two institutions, and a long and rewarding research programme is anticipated through this joint acquisition.

By Thembeka-Ntuli Mpapama (Unisa) and Dr Deshenthree Chetty (Mintek)

First time publishers in DMIE

(i) Kgabo Mokgohloa. Lecturer, researcher and PhD student

1. Tell us about yourself...?

Kgabo Mokgohloa was born and bred in Limpopo and attended the DG Tsebe High School in Mahwelereng, Mokopane. He studied for a National Diploma in Chemical Engineering at the then Technikon Northern Transvaal and then studied for a Bachelor of Technology in Industrial Engineering at the then Pretoria Technikon – both these institutions are now part of the amalgamated Tshwane University of Technology. He decided to further his studies by registering for a Graduate Diploma in Engineering at the School of Civil and Environmental Engineering at Wits University, and completed a Master of Technology in Industrial Engineering at Tshwane University of Technology. He is currently registered for a PhD with Unisa.

His career spans from working for the Council for Scientific and Industrial Research (CSIR) as a chemical engineering technologist, to a junior industrial engineer at Volkswagen, South Africa, an industrial engineer at the South African Post Office, an industrial advisor at the Gauteng Manufacturing Advisory Centre, a process engineer at Pyromet Technologies, a coordinator at the National Economic Development and Labour Council (NEDLAC) and back to the South African Post Office as an industrial engineer, where he was promoted to Senior Manager Group Sustainability and later to General Manager Value Added Services. He then decided to follow his purpose in life and his passion by joining Unisa as a lecturer and researcher.

Kgabo is passionate about science, engineering and technology research and African literature – he enjoys writing both academic articles and telling stories through poems and novels and is the author of a novel titled *Unchained*.

2. What about the Department of Mechanical and Industrial engineering (DMIE) at Unisa made you decide to do your postgraduate degree here?

As a new staff member of the Department of Mechanical and Industrial Engineering, I was impressed by the professionalism and spirit of excellence espoused by the leadership and the administrative and academic staff of the Department and I was convinced that registering for a PhD with the Department is appropriate –based on the support I received from everyone I interacted with.

3. How did you end up deciding to do the specific project for your qualification?

I was in the postal sector for most of my career and I understand the impact that the postal service had in the past, its current influence and what it could do in the future to better serve the society at large. Therefore, I found it appropriate and relevant to undertake this research to benefit the postal sector not only in South Africa but in the entire region of Southern Africa.

4. What is the project about and what do you feel are the practical implications of the research?

The aim of the proposed study is to develop through a value-engineering approach an adoption and diffusion prognostication tool for the postal industry (ADOPT) in the Southern African context that simultaneously focuses on improving the performance of the four dimensions of the 2IDP and improving profitability. In the 21st century where innovation and technology change the landscapes of businesses and society daily and a novel tool, capable of predicting peak-level adoption and the time it takes to diffuse the innovation or technology throughout the organisation, will be a critical success factor to excellence in a world that is driven by volatility, uncertainty, complexity and ambiguity (VUCA).

5. What is the title of the paper you published?

The name of the published paper is "leadership competencies for high performance: a quality systems perspective".

6. Where was this this paper published?

In the International Journal for Industrial and Systems Engineering.

7. Would you say you learned something from the experience of publishing? And if you have, please share it with us.

I have learned that cooperation with other researchers is key to publishing quality papers in leading journals as well as profiling questions for members of the department and postgraduate students who published for the first time.

Ilunga Jeanmark Tshimanga

1. Tell us about yourself.

My name is Ilunga Jeanmark Tshimanga, born and raised in Lubumbashi. Lubumbashi is one of the main cities in the DR Congo and is usually referred to as the capital of copper as the city is surrounded by mining companies. After I completed my state diploma in Automotive Mechanics at Salama Technical Institute in Lubumbashi, I moved to South Africa to pursue a university degree in Engineering with the support of my family. I finally obtained my B Tech in Mechanical Engineering and now I am in the last stage of completing my master's degree. Besides my academic history, I see myself as a family person, a believer and an explorer, a dancer and a singer. I enjoy discovering new things and new places while I am in good company.

2. What about the Department of Mechanical and Industrial Engineering (DMIE) at Unisa made you decide to do your postgraduate degree here?

DMIE is a friendly environment. Working with Professor Ho on my B Tech final project convinced me to become a researcher. He encouraged me to get involved and gave me the support I needed to work towards my goal. On the other hand, the DMIE is growing and now has better facilities to conduct research, which makes it more interesting to be part of this growing department.

3. How did you end up deciding to do this specific project for your qualification?

After discussing my studies on a few occasions with Prof Ho, I realised I was more interested in experimental work. The project grew from his collaboration with Dr Malebogo from UCT. We discussed what could be done, and from that moment on, it has been a great experience on my side.

4. What is the project about and what are the practical implications of the work?

We are using particle image velocimetry (PIV), which is a flow visualisation tool in fluid mechanic, to investigate blood flow in arteries by using an experimental model made from 3D printing. As this is an experimental project with a lot of practical implications, we must build the entire experimental setup that requires a lot of time in the laboratory to master the PIV technics and generate results. These results could in turn be used in further studies, mostly to validate computational CFD works. It can also be used to get more insight in the hemodynamic inside blood vessels and more specifically in aneurysms.

5. What is the title of the paper published after your oral presentation at the 8th International Conference on Biomedical Engineering and Biotechnology (ICBEB 2019) in Seoul, Korea?

"Particle image velocimetry analysis of blood flow in idealised cerebral aneurysms using the refractive index matched 3D printed flow phantoms".

6. Where was this this paper published?

It was published in the *Journal of Cardiovascular Engineering and Technology* with the title *"Evaluation of a desktop 3D printed rigid refractive-indexed-matched flow phantom for PIV measurements on cerebral aneurysms"*.

7. Would you say you learned something from the experience of publishing? If you have, please share your experience.

Through my contribution to the drafting of the paper and during the whole process, I have gained experience regarding the quality of the work that is required in order to be published in a top journal. In my opinion, the novelty of the research is important as well as your writing skills in order to produce a good article – profiling questions for members of the department and postgraduate students who published for the first time will also help them.

Tolulope Babawarun

1. Tell us about yourself.

My name is Tolulope Babawarun, I am from Nigeria and I was born on 30 April 1989. I am presently registered for my MTech at Unisa and I completed my first degree at the Federal University of Technology in Minna, Nigeria.

2. Why did you decide to do your postgraduate degree at the Department of Mechanical and Industrial Engineering (DMIE) at Unisa?

I decided to pursue my master's degree at Unisa because of the facilities that was available to me and the opportunity to grow and develop my research work.

3. How did you decide to do the specific project for your qualification?

Through brainstorming and collaboration with my supervisors.

4. What is the project about and what are the practical implications of the work?

The project is about renewable energy, wind turbines to be specific, and the need to improve its performance by reducing the vibration of the blades. It is important in a practical sense: the wind turbine is a clean source of power generation, hence the need to improve its performance.

5. What is the title of your published paper?

It is "Stress validation of the finite element model of a small scale-wind turbine blade".

6. Where was this this paper published?
In the *Journal of Energy in Southern Africa (JESA)*.

7. Would you say you learned something from the experience of publishing?

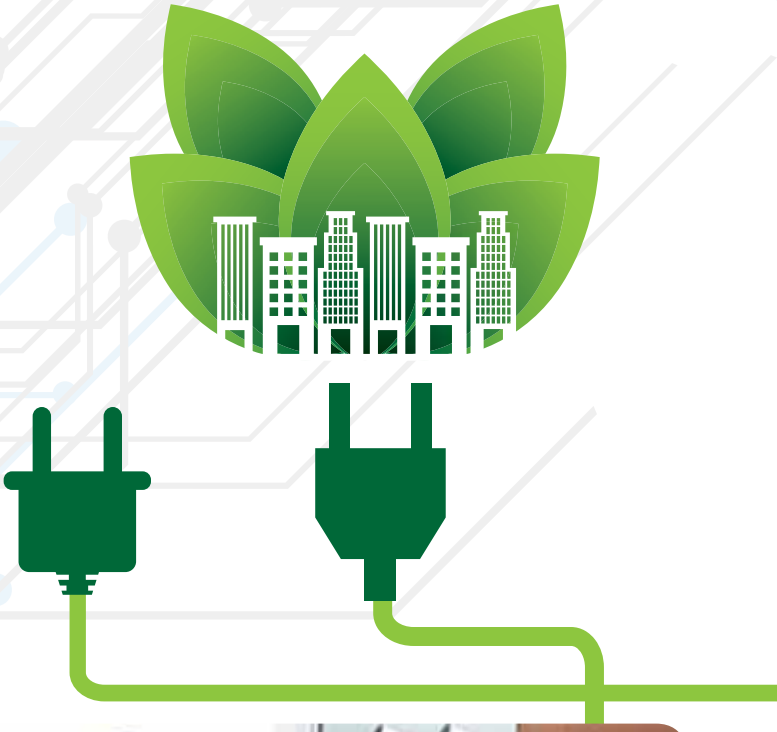
I learned that it takes discipline and hard work to publish a paper in a journal. It also entails a lot of patience.

Unisa at the forefront of a sustainable future

The International Conference on Advances in Renewable Energy and Green Technologies (ICARE) 2019, was held from 24 to 26 August but a meeting was held beforehand to discuss a collaborative conference. Discussions were held with the organiser of the conference, Dr Senthil Kumar; the founder and chancellor, Dr Govindasamy Viswanathan; the vice president, Dr Sekar Viswanathan; the pro-vice chancellor, Prof S Narayanan; and the vice-chancellor, Anand Samuel.

The Conference was aimed at bringing together academia, manufacturers, engineers and customers from all over the world to deliberate on the challenges and opportunities faced by the energy sector in the wake of dwindling natural sources and increasing concern over climate change. It provided a premier multidisciplinary platform for stakeholders to present and discuss the most recent innovations, trends and concerns, as well as practical challenges encountered and solutions adopted towards the development of green and sustainable technology in the areas of solar, wind and biotechnology.

As a co-organiser of the conference, Unisa was provided with an international platform and as a major stakeholder, Unisans were exposed to research and state-of-the-art equipment with the collaborating institutions.



Professors Veeredhi Vasudeva Rao, Fulufhelo Nemavhola and Kemlall Ramdass visited the Vellore Institute of Technology (VIT) in Vellore, India, from 27 to 29 May 2019 on behalf of Unisa, the College of Science, Engineering and Technology (CSET), and the Department of Mechanical and Industrial Engineering

The exchange of students and faculty members and joint research projects

While the primary objective was to visit VIT, the team also called in on Vel Tech University and as a result, Unisa is in the process of concluding memoranda of understanding (MoU) with these two institutions.

VIT and Vel Tech were established with the aim of providing quality higher education on par with international standards. The global standards set by the universities in the field of teaching and research spur them on in their relentless pursuit of excellence.

The MoUs will provide opportunities for an exchange of students and faculty members and encourage joint research projects for the mutual benefit of the signatories.

During discussions, the team achieved a draft memorandum of understanding on various aspects.

Aims and form of co-operation

- Exchange of students: Organising study visits and training, participation in bachelor, master's and doctoral courses, recognition of academic credits, guidance and supervision of student theses and project work. Towards this purpose, a few scholarships to meet students' living expenses, partly or wholly, may be made available on both sides.
- Exchange of faculty members: Planning and handling of academic programmes and courses, organisation of seminars, workshops and conferences, including the exchange of mutual experiences in teaching, research and industrial practice.
- Exchange in research: Joint programmes in research and development, including the exchange of publications and reports.
- Twinning programmes: Explore the possibilities of joint twinning programmes in interdisciplinary areas of specialisation of high relevance to both institutions.
- Centres of excellence: Creation of centres of excellence in specialised fields of mutual interest in science, engineering and technology.
- Faculty and student exchange
- Joint conferences
- Joint research and publications

Immediate areas of cooperation

Discussions were held on select projects of mutual benefit, such as BRICS applications for funding, the organising of international conferences (annually/bi-annually) and extending research facilities to staff and students.

**** By Kemlall Ramdass, Associate Chair of Department: External Affairs, Department of Mechanical and Industrial Engineering***

Sasol Expo: meeting the future engineers

When learners visited my workstation, they were not aware that they can pursue mechanical Engineering as a career. At the Expo, they learn about different specialisation fields in Mechanical Engineering such as design, manufacturing and automotive engineering. The students also learned the basic principles of mechanical engineering, its application in everyday life, as well as its advantages. We gave them a brief description of/demonstration on the principles of the vapor power cycle and an understanding of the components that produce energy, using the Rankine cycle.

We also gave them demonstrations of a mini Pelton turbine in which the pressure energy of water is converted into kinetic energy to form a high speed water jet that strikes the wheel tangentially to make it rotate. After I interacted with the learners, they were more interested in a career in Mechanical Engineering

Science, engineering and technology in rural villages

Engineers for rural villages

The Department of Mechanical and Industrial Engineering has several initiatives regarding community engagement projects that normally assist people in deep rural villages. One of the projects is called Engineers for rural villages, where staff members visit various rural villages across South Africa.

As information about furthering your studies at a university can be hard to find in rural areas, Venda enjoyed and appreciated a visit from academics from the College of Science, Engineering and Technology of the Department of Mechanical and Industrial Engineering at Unisa. The group of the enthusiastic academics embarked on a mission to inspire village kids and from 11 to 13 April 2018, four professors, three doctors, one lecturer, one master's student and one marketing representative participated in this community engagement project.

The academics visited seven schools in different areas and municipalities of Venda, the Humbelani Secondary School, Vhulaudzi Secondary School, Hanyani Secondary School, Mubalanganyi Secondary School, Gwamasenga Secondary School, Lwenzhe Secondary School and Tshinavhe Secondary School.

The purpose of the trip was to expose the learners to Science, Engineering and Technology and to talk about career choices and bursaries offered by companies. We also wanted to build a relationship with one of the schools in the villages to help them solve their problems by using engineering solutions. The school that was chosen was Hanyani Secondary School in Tshipise. The learners mentioned that some of the challenges they are facing on a daily basis are the shortage of water, electricity, a lack of science laboratories, and a library.

Hanyani Secondary School in Tshipise, Venda

The Gwamasenga Secondary School was one of the schools we visited and is Dr Ndou's former school where he matriculated. Our visit really inspired them and the learners vowed that the school will produce more academics. Now they know that it is possible to achieve your goals despite your background.

Gwamasenga Secondary School, Thohoyandou, Venda

Science, engineering and technology in rural villages

This visit was much appreciated by the learners, educators and principals of the schools. The principal of the Hanyani Secondary School said, "In the history of our school, we have never seen four professors at the same time in our school. Today the academics were not speaking from the book but from the heart. This is a great honour to us. We really appreciate your visit". He also said that he hoped that this was not the last time the academics visited the school. One of the learners, who was the president of the LRC (learners representative committee) thanked us for visiting their school and said that he now have the confidence to study engineering. He also encouraged his fellow learners to take the visitors' advice to go out in the world to fulfil their dreams.

This visit was also a learning curve for the academics who realised that the villages have people with great potential. After engaging in questions and answers with the learners, one come to realise that there are motivated young people out there who just need information to help them fulfil their goals and achieve their dreams.

Unisa academics addressing Tshinavhe Secondary School learners in Vuwani, Venda

Prof Fulufhelo Nemavhula, Chair of the Department of Mechanical and Industrial Engineering promised that there will be another visit to Venda, though this time around, they will only visit Hanyani Secondary School to start the project with them – this project is part of the community engagement project of Department.

Department of Mechanical and Industrial Engineering (DMIE) at Edenvale Hospital: Lean Healthcare Project

As part of its outstanding community engagement pillar, the Department of Mechanical and Industrial Engineering (DMIE) has embarked on a Lean Healthcare Project with Edenvale Hospital. Dr Mathaba from Edenvale was instrumental in facilitating the intervention by DMIE with a view of implementing lean healthcare as a way of thinking that focuses on creating value and eliminating waste.

Some of the complaints that led to the Hospital's management requesting an intervention by the DMIE were:

- long waiting times by patients
- long journey times for patients
- patient dissatisfaction
- bottlenecks in the processes
- stress of over-work by clinicians and administration staff

The Lean Healthcare Project at Edenvale Hospital has the following overarching objectives:

- It should be way of thinking or a strategy.
- It should be about specifying value from the patient's point of view.
- It should be about continuous process improvement.
- It should be about buy-in and involvement (involving and empowering those who do the work in business process re-engineering and business process management).
- It should be about "seeing" all the work at Edenvale Hospital as a process rather than as silos.
- It should be about achieving smooth continuous process flow.

Department of Mechanical and Industrial Engineering (DMIE) at Edenvale Hospital: Lean Healthcare Project

The implementation of the Lean Health Project is aimed at ensuring that the Hospital can do more with less inventory, time, money, problems and resources through the efficient and effective utilisation of resources available to Edenvale Hospital.

The goal is to improve the flow of processes, materials, information, human capital, capital equipment and ultimately, the smooth flow of patients

Through the implementation of pull systems, value stream mapping, demand levelling, the elimination of the eight wastes, the five S system, visual management, one-piece-flow, quality control and assurance and other lean techniques, Edenvale Hospital has started to reap the rewards in the short and medium term. The rewards of implementing the Lean Healthcare Project are cost optimisation, quality improvements, faster response times, improved productivity, improved staff morale, improved patient satisfaction, improved flow and many other benefits.

Since the start of the Project, the board of directors, management and staff were encouraged by the feedback received from patients. When the DMIE Lean Health Team is on the floor, there is without fail positive feedback from the patients.

By K Mokgohloa, N Mosia, D Kruger and S Mathaba

DMIE-Merseta partnership producing well-trained engineering students

The placement of engineering students in the industry has remained a challenge for the College of Science, Engineering and Technology (CSET). To improve the situation and to assist all engineering students, the executive dean of CSET decided to engage all relevant SETAs in South Africa. As a result, CSET received funding to the amount of R3 000 000.00 (three million rand) and R7 040 000.00 (seven million and forty thousand rand) from EWSETA and MERSETA respectively. These funds will assist engineering students who are unable to fund their own studies as well as those who are unable to get a placement in the industry. All students registered for an engineering qualification at CSET are required to go through practical training by means of placements in the industry.

About 70 students across the engineering field are placed to do their P1 and P2 work-integrated learning. During this training, the students are expected to design and build anything that could be useful to the community at large. In this case, the engineering students have chosen to design and build a solar wheel chair. It is understood that this solar wheelchair will be distributed to poor communities once completed.

According to the project assistant, Mr Sandile Khambule, P1 and P2 students managed to develop the following: an inventor/cad, hand tools, power tools, welding, machinery, two manual wheel chairs, a solar power wheel chair and a Mini Baja. The solar car is still in progress.

DMIE-Merseta partnership producing well-trained engineering students

Industrial engineering P2 students did the following project at the hospital under the supervision of Prof D Kruger and Mr N Mosia: lean tools, value engineering, throughput, total quality management, supply chain management (inventory), line balancing, sensitivity analysis, business process improvement, visual management and facility layout.

Our students are ready to face the industry with the skills they managed to acquire in our workshop. We also had a second intake of P1 students, who develop an inventor/cad – they are still busy with the hand tools.

Internationalisation

According to the executive dean, Prof BB Mamba, of the College of Science, Engineering and Technology, 2019 was a year of intensifying internationalisation. In the spirit of adopting excellence in the Department of Mechanical and Industrial Engineering (DMIE), we thought that internationalisation is aligned to the core values of staff members. In this regard, the internationalisation project was designed to ensure that staff members are afforded an opportunity to benchmark and work with top scholars from top universities in the world. This was obviously done to ensure that research and teaching excellence is adopted without hesitation.

Research excellence cannot only be a dream and to achieve this dream, hard work is required from all stakeholders. It is vital that quality research output plays an important role in knowledge generation, which has an impact on the local economy.

Also, the production of high-quality engineering graduates is vital in the development of engineers in general as they play an important role in the economy. Working with peers across the globe in engineering disciplines is vital to ensure that students receive a well-tested education. The DMIE staff members will also benefit in terms of potential research collaboration, student exchange, staff exchange and visiting professor appointments.

In this regard, the chair of the Department of Mechanical and Industrial Engineering has visited a number of countries including India, Belgium, the United Kingdom, the United States and the Netherlands – see VIT https://www.vit.ac.in/), VelTech (https://www. veltech.edu.in/), the University of Ghent (https://www. ugent.be/en), the Cranfield University (https://www. cranfield. ac.uk/) and the University of Massachusetts (https://mie.umass.edu/) and TUDelft (https:// www.tudelft.nl/en/) respectively.

ICARE 2019 Conference

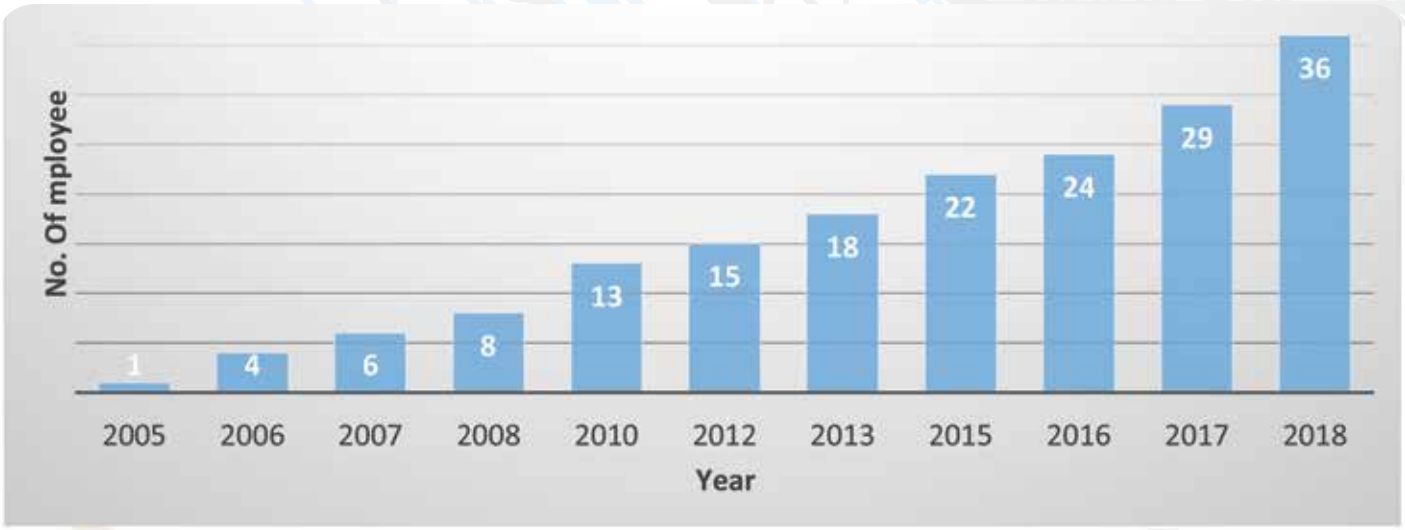
At the ICARE Conference held from 22 to 24 August 2019, Mr Shumani Ramuhaheli won the best paper award for his paper on the "Advances in Renewable Energy and Green Technology". The National Institute of Wind Energy (NIWE), the Energy and Resources Institute (TERI), and the University of South Africa (Unisa) have joined hands with VIT University in organising this conference.

There is an ever increasing demand for energy to meet the needs of mankind. As a result, the consumption of conventional fossil fuels such as diesel and other petroleum products increased exponentially during the last five to six decades. This in turn created a threat for the environment by increasing pollution levels beyond acceptable levels. Factors such as environmental rapidly depleting fossil fuels pollution have created an urge to find alternative fuels. Biodiesel is recognised world wide as an alternative fuel to run diesel engines. But the high density and viscosity of biodiesel affect the fuel spray characteristics and combustion quality. Fuels such as biodiesel from waste vegetable oil and fresh vegetable oil blended with an alcohol blend may present a sustainable solution by decreasing the viscosity and density of the fuel.

The present investigation evaluates the effects of alcohol to biodiesel on a diesel engine. The objectives of this paper was to investigate the effect of a diesel fuel, biodiesel and a biodiesel-alcohol blend on the properties, performance and emission characteristics of a single cylinder, direct injection (DI) diesel engine. In this investigation a single cylinder, direct injection (DI) diesel engine is employed to study the engine performance and emission characteristics at low load conditions at different engine speeds.

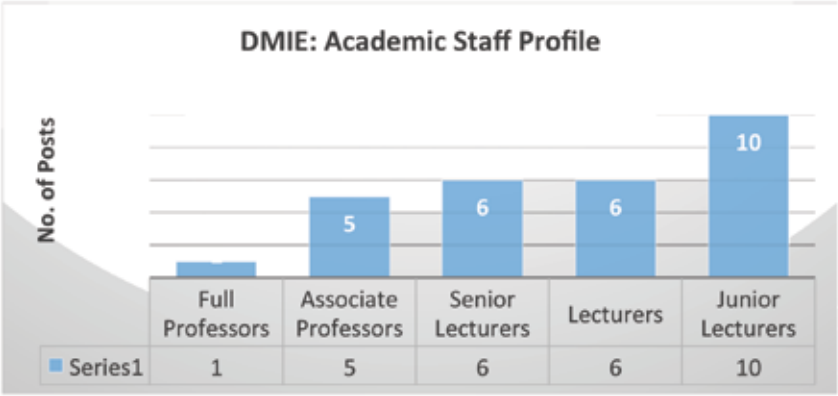
Key highlights of the Department of Mechanical and Industrial Engineering

DMIE Strategic sessions

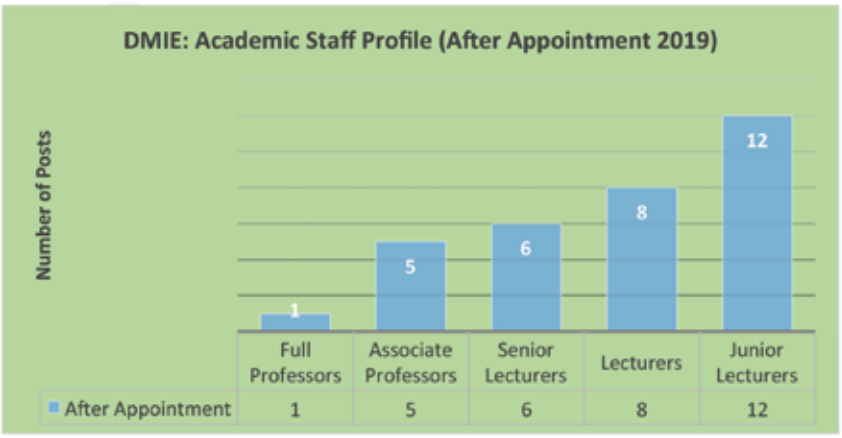


DMIE Staff (Permanent) Yearly Growth (3)

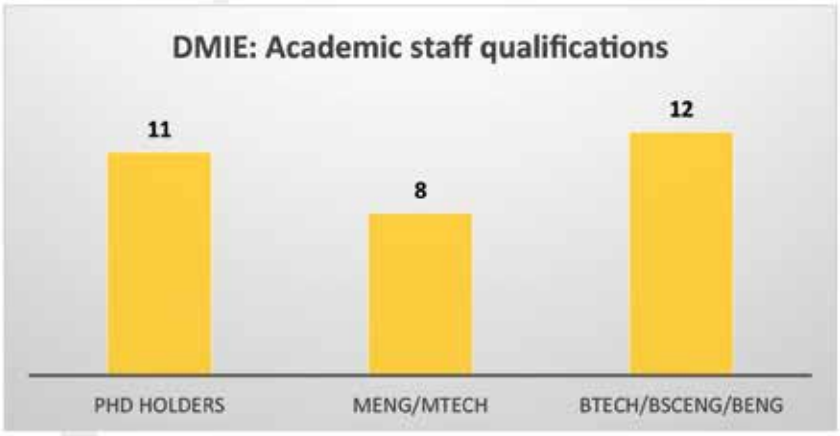
DMIE: Staff Profile (Permanent – Full time)



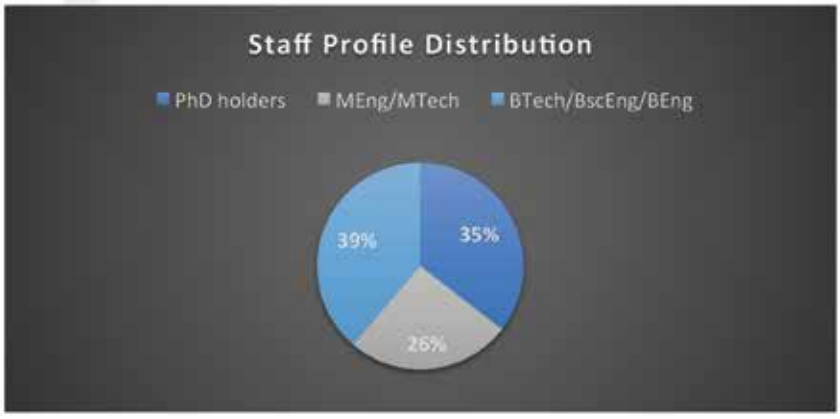
Full Professor	1
Associate Professors	5
Senior Lecturers	6
Lecturers	6
Junior Lecturers	10
Secretary	1
Administrators	3
Technical Officers	3
TOTAL	35



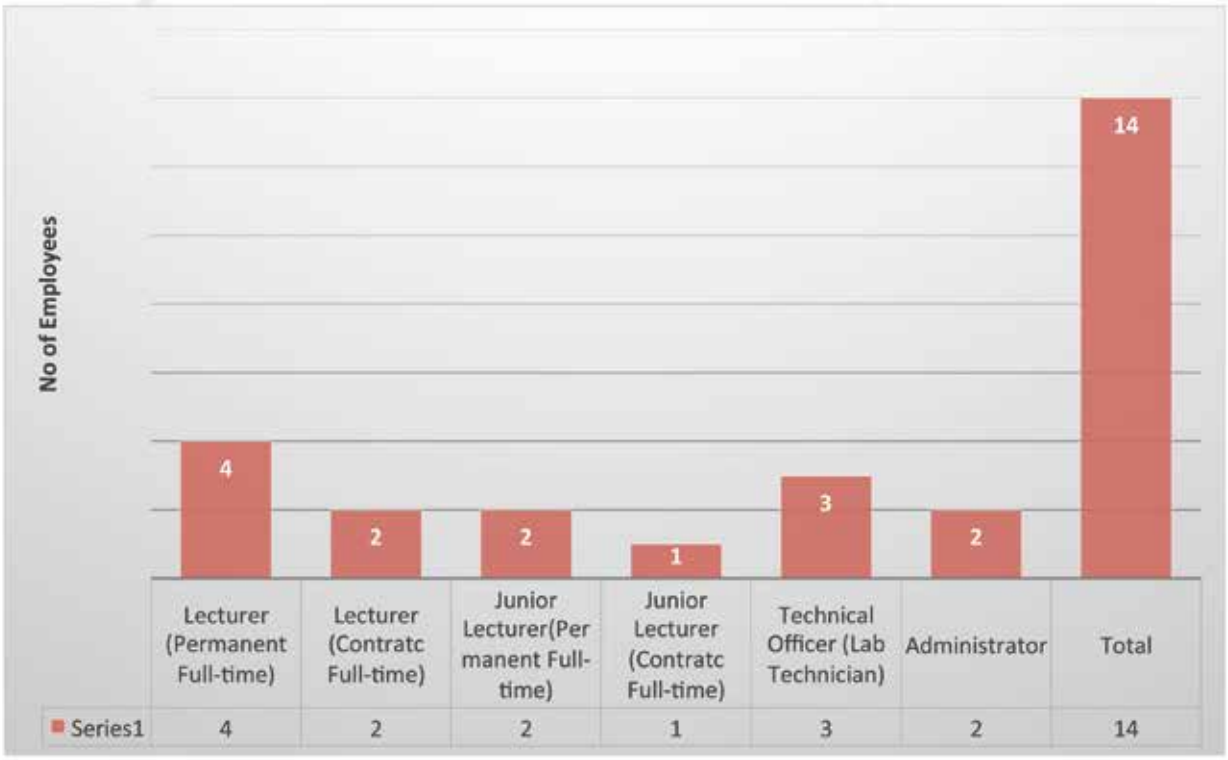
DMIE: Staff Qualifications



PhD holders	11
Master's degree	8
BTech/BEng	12
Registered Masters	4
Registered PhD	5

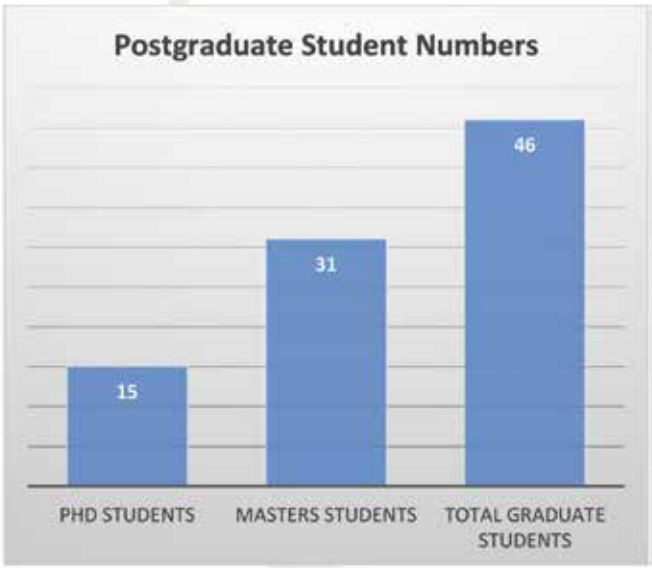


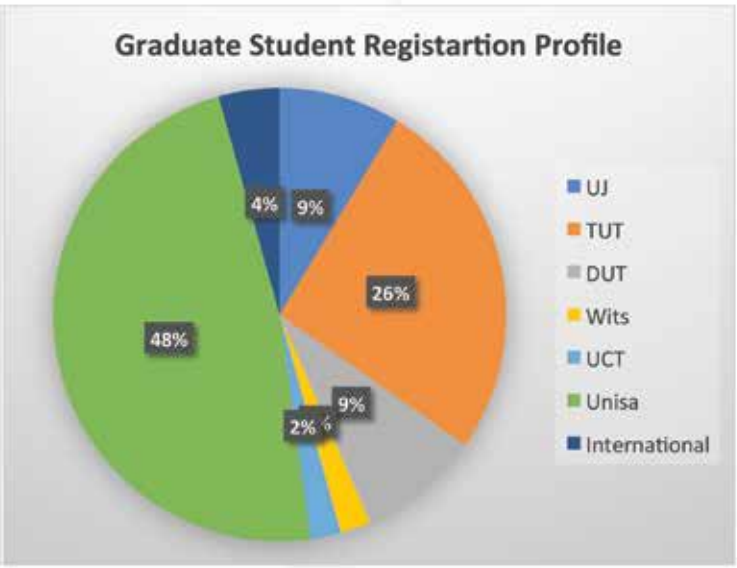
New appointment since 2015



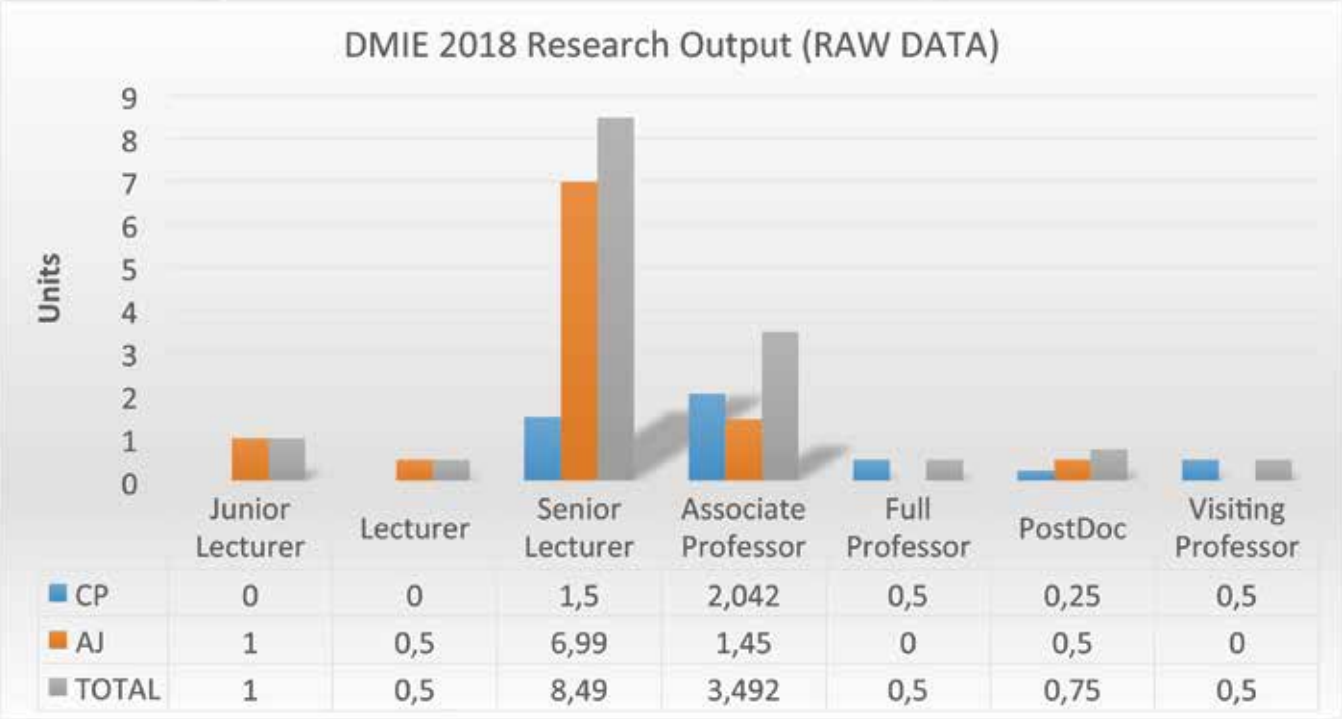
Where do we register postgraduate students?

No postgraduate qualifications but….





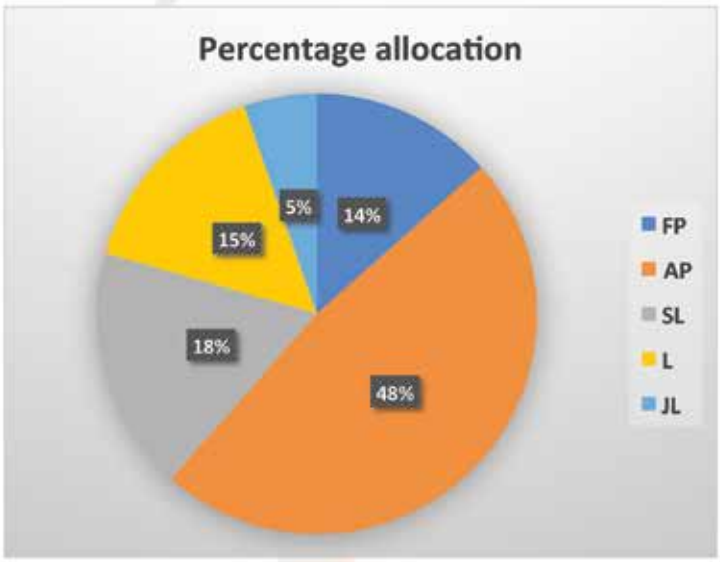
DMIE: Research Output (2017) – 14.

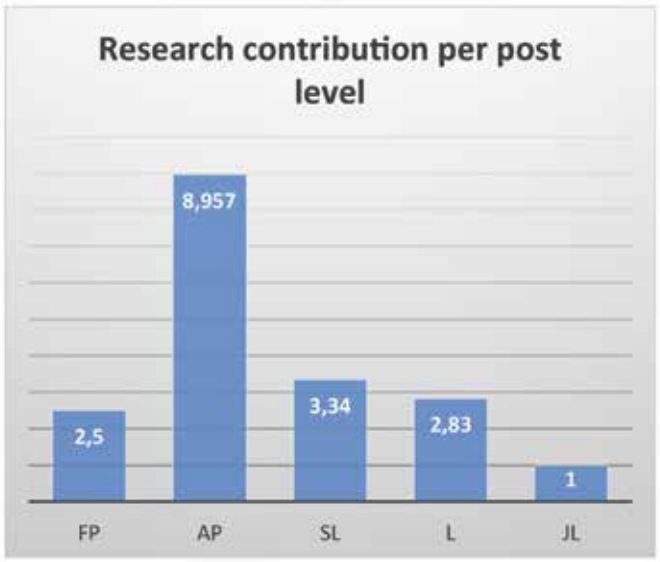


	Junior Lecturer	Lecturer	Senior Lecturer	Associate Professor	Full Professor	PostDoc	Visiting Professor
CP	0	0	1,5	2,042	0,5	0,25	0,5
AJ	1	0,5	6,99	1,45	0	0,5	0
TOTAL	1	0,5	8,49	3,492	0,5	0,75	0,5

DMIE: Research Output (2019) – 18,63

2019 target: 14 ROUs





1st Unisa Industrial Engineering and Robotics Symposium (IERS 2019)

The DMIE 1st Industrial Engineering and Robotics Symposium (IERS) took place on 23 and 24 October 2019 at Mistry Hills in Muldersdrift.

The event was attended by delegates from both private and public companies, including the South African Air Force and ARMSCOR. A number of presenters outlined the application of 4IR in their respective industries and in academia. This included artificial intelligence, robotics, big data and big data analytics, autonomous systems, and unmanned aerial vehicles.

The symposium culminated with the appointment of an academic multi-stakeholder steering committee comprising of representatives from Unisa, TUT, WITS and UJ to prepare a report that is to be presented to government on findings and recommendations that arose from the IERS 2019.

DMIE Advisory Board 2019

The DMIE Advisory Board meeting took place on 4 December 2019 at the Unisa Florida Campus. DMIE hosted members of the advisory boards from various industries and universities such as the University of Johannesburg and Wits University.

The Advisory Board deliberated on a number of presentations made by DMIE, and in particular the new Programme Qualification Mix Issues, which included:

- sustainable development
- new programme qualification mix (PQM)
- articulation of phased out programmes into new qualifications
- ECSA graduate attributes
- work-integrated learning (WIL)
- laboratories

The Advisory Board concluded with members visiting state-of-the-art DMIE laboratories. The next Advisory Board will take place on .....