Junie 2014

Eng-Postgrad

Fakulteit Ingenieurswese Nagraadse Nuusbrief

Graag wil ons vir spankaptein Jos van der Westhuizen, en die res van sy taai en tawwe *Meganiese en Megatroniese Ingenieurswese (M&M)* span, baie hartlik gelukwens met hul opwindende oorwinning in die Rotsklim en Foefie-gly kompetisie tydens die nagraadse sosiale geleentheid in April vanjaar!

M&M se wenspan het bestaan uit die onderstaande spanlede, tesame met vier entoesiastiese en uiters stoute "gatecrashers" vanaf ander departemente! Agter (v.l.n.r.) is Heimriks Nel, Rico Swanepoel, Coenraad Swanepoel, Franco van Wyk, David Ellis, Aaron Corr, Tim Angus MacDonald, Gregor Reichmuth, Jos van der Westhuizen; en voor (v.l.n.r.) is Rudolph Botha, KJ Hendler, Eduard Kieser, Ana-Mia Louw, en Rosca de Waal. Elkeen van die spanlede het na afloop van die wedstryd 'n oulike klein "Trust Me, I'm an Engineer" stoeltjie ontvang, waarna Prof Perold die gesogte Ingenieurswese Beker aan Jos van der Westhuizen oorhandig het.

Baie dankie ook aan Anton Jordaan vir die pragtige foto's en dat hy ingestaan het vir AM de Jager, wat oorsee rondrits!

Heel bo: Die tawwe rotsklim-span van Meganiese en Megatroniese Ingenieurswese (M&M) spog met hul welverdiende oorwinning!
Bo links: Prof Willem Perold oorhandig die Ingenieurswese Beker aan trotse M&M spankaptein, Jos van der Westhuizen.
Bo regs: M&M spanlid Ana-Mia Louw het vir die res van die spanne gewys wat gedoen moet word om die Ingenieurswese Beker in te palm.

UNIVERSITEIT STELLENBOSCH UNIVERSITY

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Siviel organiseer CEM Industrie Opedag

Op 30 Mei vanjaar het die Konstruksie-Ingenieurswese en -Bestuurafdeling (Construction Engineering and Management division, CEM) hul eerste Industrie Opedag aangebied. Die Opedag was baie suksesvol met ongeveer 15 industrie verteenwoordigers wat die dag kon bywoon.

Volgens Chris Jurgens van die *Departement Siviele Ingenieurswese*, was een PhD student en agt MIng studente van die departement die geleentheid gegun om hul navorsing by wyse van 'n aanbieding te verduidelik. Daarna kon die verskeie industrie verteenwoordigers ook kommentaar lewer. Die CEM afdeling beskou hierdie interaksie met die groter industrie as noodsaaklik om te verseker dat hul navorsing in lyn is met die Suid-Afrikaanse mark. Die deelnemende MIng studente was Charlie de la Haye, Paul Duvenage, Emile Klopper, Louwrens Mostert, Patrick Onkwonko, Philip Piek, Mahsa Tabesh, en Marijn van den Berg; asook Sitwala Simushi (PhD student).

Na afloop van 'n ligte ete het die industrie deelnemers die geleentheid gekry om hul kwessies te opper, en meeste van die nagraadse studente kon direk hierby baat vind.

Die CEM afdeling hoop om hierdie industrie-kontakte te versterk en uit te brei, en daar word nou reeds beplan aan die volgende Industrie Opedag!

Chris Jurgens tydens die CEM Industrie Opedag

Geopolymer Concrete: Cement for the Future

Ryno Barnard is a second year MEng student at the Structural Engineering Division, which forms part of the *Department of Civil Engineering*, and is currently investigating geopolymer concrete, an alternative type of construction material which has the potential to replace conventional concrete. Approximately 7% of the world's greenhouse emissions into the atmosphere are due to the production of ordinary Portland cement, which is the conventional binder material used in concrete. The carbon footprint of cement is, on average, around 820 kg CO_{2e} per tonne of cement manufactured.

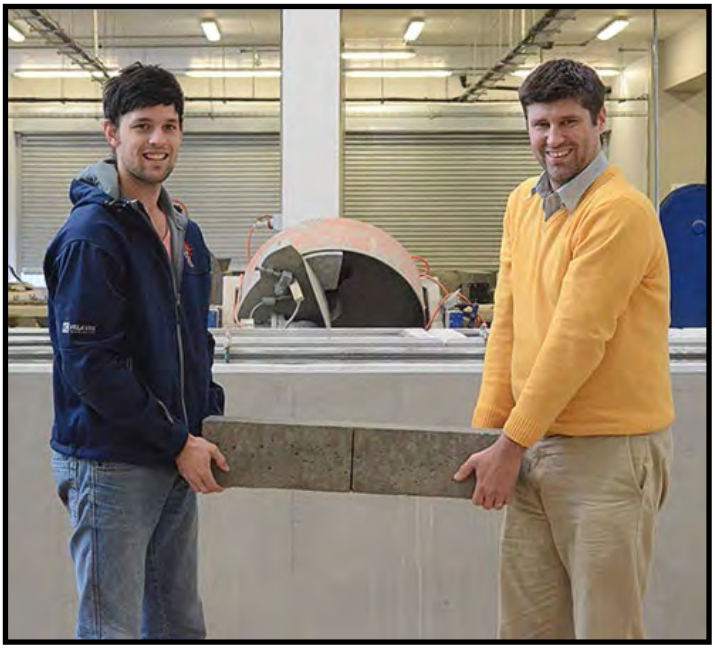
This new innovative construction material consists of 0% cement and is significantly more environmentally friendly than conventional concrete. The main constituents of the geopolymer concrete are a combination of fly ash (a by product of the burning of coal at power plants) and slag (a by product of the steel manufacturing industry), which acts as the binder, and then an alkaline solution consisting of sodium hydroxide and sodium silicate, which acts as the hardener. Geopolymer concrete hardens through a process called geopolymerisation in which the silica and aluminium ions interlock with oxygen ions to form the hardened material. The alkaline liquid helps to break down the source material in order to free these ions.

Research has been done on the mechanical properties of geopolymer concrete in order to investigate how the different constituents in the matrix influence the compressive strength of the material. Impressive compressive strengths of over 70 MPa have been obtained, even while curing at ambient conditions, which shows that geopolymer concrete is indeed a promising material.

Ryno is not only investigating the mechanical properties, but is also looking at adding steel and/or polypropylene fibres in order to improve the tensile strength and increase the ductility of geopolymer concrete.

Although there is still much work to be done on improving this new binder material, it is a step in the right direction and can certainly be beneficial for both the natural and the built environment.

Prof Billy Boshoff is Ryno's study leader at the Department of Civil Engineering.



Ryno Barnard (left) and Prof Billy Boshoff with a slab of geopolymer concrete, a potential replacement for conventional concrete.

Yuda Benjamin obtains PhD qualification

Congratulations to Yuda Benjamin for obtaining his PhD qualification during the April '14 graduation ceremony!

Title:	Sugarcane cultivar selection for ethanol production using dilute acid pretreatment, enzymatic hydrolysis and fermentation
Department:	*Department of Process Engineering*
Promoter:	Prof JF Görgens
Co-promoter:	Dr M Garcia-Aparicio

Dr Yuda Benjamin with his daughter Jackie.

Summary:
Improving sugarcane properties for combined bio-ethanol production (from juice and fiber) requires cultivar development and selection of preferred varieties. Identification of the novel varieties for combined ethanol production from juice and fibre has not been incorporated into previous crop development programs in South Africa. A novel scientific methodology for selection of varieties with advantageous traits including agronomic properties combined with high processability of the fiber was developed. By using dilute acid pretreatment, enzymatic hydrolysis and fermentation it was demonstrated that ethanol production from fibre could be improved significantly, using preferred varieties. Farmers and biofuels sectors can benefit from this methodology.

Dev Groenewald obtains PhD qualification

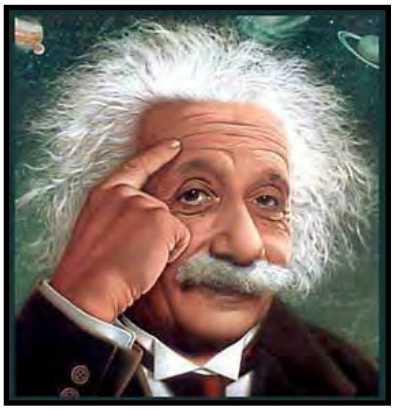
Dr Dev Groenewald

Congratulations to Dev Groenewald for obtaining his PhD qualification during the April '14 graduation ceremony!

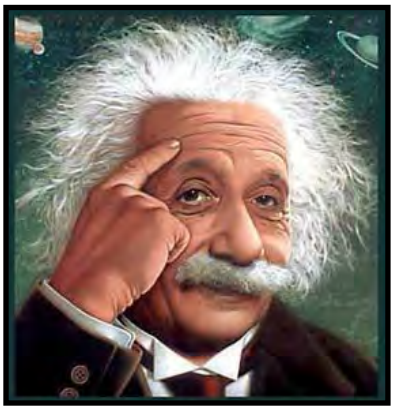
Title:	A process performance monitoring methodology for mineral processing plants
Department:	*Department of Process Engineering*
Promoter:	Prof C Aldrich
Co-promoter:	Prof SM Bradshaw and Prof G Akdogan

Summary:
Key to remaining competitive within the mineral industry is ensuring that processes are operated optimally as far as possible. To this end a methodical approach to plant-wide process performance monitoring for mineral processing plants was developed based upon the integration of process causality maps with data-based systems. The application of process causality maps significantly simplified process monitoring and improved the interpretability of the results through a reduction in complexity. Moreover, extreme learning machines were identified as a promising algorithm for the data analytical techniques forming part of a process performance monitoring solution.

April 2014 Cum Laude Graduandi



Dit is vir die Fakulteit Ingenieurswese 'n groot voorreg om die volgende studente hartlik geluk te wens met hul uitsonderlike prestasie in die voltooiing van hul meestersgrade. Hierdie MScIng/MIng studente het in April vanjaar met *cum laude* gegradueer, en met so 'n uitmuntende studierekord kan hulle nie anders as om suksesvol te wees nie.
Ons lig ons hoed vir hul dissipline en toegewydheid, en wens hulle alle voorspoed toe met hul rooskleurige toekomsplanne!



CUM LAUDE GRADUANDI

Andre Hartmann	Bedryfsingenieurswese	MIng
Bernie Lindner	Bedryfsingenieurswese	MIng
Don van Blommestein	Bedryfsingenieurswese	MScIng
Esmarie Scholtz	Bedryfsingenieurswese	MIng
Graziano Marcantonio	Bedryfsingenieurswese	MIng
Sarel van Baalen	Bedryfsingenieurswese	MIng
Anneke Stofberg	Elektriese en Elektroniese Ingenieurswese	MIng
Darren Croucher	Elektriese en Elektroniese Ingenieurswese	MIng
Johann Botha	Elektriese en Elektroniese Ingenieurswese	MIng
Jonathan Nye	Elektriese en Elektroniese Ingenieurswese	MIng
Nicholas Thompson	Elektriese en Elektroniese Ingenieurswese	MIng
Stefan Alberts	Elektriese en Elektroniese Ingenieurswese	MIng
Van Zyl van Vuuren	Elektriese en Elektroniese Ingenieurswese	MIng
Dirk Munro	Meganiese en Megatroniese Ingenieurswese	MIng
Mathew Joubert	Meganiese en Megatroniese Ingenieurswese	MIng
Samantha Bartle	Meganiese en Megatroniese Ingenieurswese	MIng
Henri Cloete	Prosesingenieurswese	MIng
Jamie Cripwell	Prosesingenieurswese	MIng
Petri van Wyk	Prosesingenieurswese	MIng
Charl Smit	Siviele Ingenieurswese	MIng
Conrad Frehse	Siviele Ingenieurswese	MIng
Karien Venter	Siviele Ingenieurswese	MIng
Louis Marais	Siviele Ingenieurswese	MScIng
Louis Theron	Siviele Ingenieurswese	MIng
Louise Smit	Siviele Ingenieurswese	MIng
Louw Venter	Siviele Ingenieurswese	MIng
Padhraic O'Connor	Siviele Ingenieurswese	MScIng
Petro Faasen	Siviele Ingenieurswese	MScIng
Robyn Kime	Siviele Ingenieurswese	MIng
Talia Schoonees	Siviele Ingenieurswese	MIng

Willem Rossouw wins Outotec Postgrad Scholarship

Willem Rossouw, an MEng student at the *Department of Process Engineering*, has been awarded an Outotec Postgraduate Scholarship by the Western Cape branch of the Southern African Institute of Mining and Metallurgy (SAIMM).

This scholarship is awarded to postgraduate students who are in their first year of study and conduct research which focuses on sustainability in mineral processing and extractive metallurgy.

Willem's postgraduate research work forms part of a project aimed at developing a hydrometallurgical process for the recovery of metals from electronic waste. This project is also supported in part by the National Research Foundation of South Africa.

The recovery of metals from electronic waste prior to disposal has become of major environmental and economic interest as a result of the fast rate of technological development that has led to a decrease in the service life of electronic devices, and an increased rate of electronic waste generation. Willem's project specifically focuses on the selective recovery of base metals by means of acid leaching processes. An important aspect of the project is to evaluate the effects of different physical separation steps employed during the pre-treatment of waste circuit boards on the efficiency of the leaching processes. Dr Christie Dorfling is Willem's study leader.

Willem Rossouw

Postgraduate Students attend MIDPREP Workshop

MIDPREP, a new European Union project, was launched in 2013. MIDPREP is an FP7 IRSES programme, which enables the exchange of knowledge and staff between two leading European research institutes (ASTRON in the Netherlands, and Chalmers University of Technology in Sweden), as well as three South African partners (Stellenbosch University, University of Cape Town, and Rand University). The partners collaborate in developing and building radio astronomy instrumentation, for example through the Square Kilometre Array (SKA) precursor MeerKAT in the Karoo as framework for (inter)national human capital, research and infrastructure. FP7 is the 7th Framework Programme for Research and Technological Development, and IRSES is an International Research Staff Exchange Scheme.

Two postgraduate students at the *Department of Electrical and Electronic Engineering*, Jacki Gilmore (PhD student) and Vereese van Tonder (MScEng student), have recently been succesful in receiving placements at ASTRON in Dwingeloo, Netherlands.

ASTRON is the Netherlands Institute for Radio Astronomy and its mission is to enable discoveries in radio astronomy via the development of novel and innovative technologies, the operation of world-class radio astronomy facilities, and the pursuit of fundamental astronomical research.

Prof David Davidson, Vereese van Tonder, Jacki Gilmore, and David Prinsloo recently also attended the first MIDPREP workshop and AAMID consortium meeting from 31 March - 2 April at ASTRON in Dwingeloo, the Netherlands.

Dr Andre Young, a postdoc under the guidance of Prof David Davidson, as well as two PhD students, David Prinsloo and Theunis Beukman under the guidance of Prof Petrie Meyer, were at Chalmers University of Technology in Sweden earlier this year, where they worked on various aspects of SKA projects.

From left to right: Vereese van Tonder, Jacki Gilmore, and Prof David Davidson during their visit to the Westerbork Synthesis Radio Telescope (WSRT) in the northeastern Netherlands.

Wikus Villet & Johannes Potgieter obtain PhD qualifications

Dr Wikus Villet (left), Prof Maarten Kamper and Dr Johannes Potgieter (right), celebrating on the steps of the Conservatoire building.

Congratulations to Wikus Villet for obtaining his PhD qualification during the April '14 graduation ceremony!

Title: Critical evaluation and application of position sensorless control techniques for reluctance synchronous machines

Department: *Department of Electrical and Electronic Engineering*

Promoter: Prof MJ Kamper

Summary:

In this study the viability of controlling the reluctance synchronous electrical machine without angular shaft position measurement for different industry applications is investigated. The three industrial applications investigated are wind generators, variable gear electric vehicle drive motors and electric mine scraper winches. Several position sensorless control techniques are investigated, implemented and evaluated at different machine power levels. Finite element analysis is used to analyse the effect of the machine geometry on the saliency-based position sensorless controllability of the reluctance synchronous machine. It is shown that the position sensorless controlled reluctance synchronous machine can be considered for various industry applications.

Congratulations to Johannes Potgieter for obtaining his PhD qualification during the April '14 graduation ceremony!

Title: Optimal topology and critical evaluation of slip synchronous permanent magnet wind generator

Department: *Department of Electrical and Electronic Engineering*

Promoter: Prof MJ Kamper

Summary:

In this study a reliable and robust, direct-drive, directly grid-connected slip-synchronous permanent magnet wind generator is proposed as an alternative to other wind generator systems. As no gearbox or power electronic converter is used the maintenance requirements of this generator system are much less. Several implementation issues are identified and addressed, such as correct parameter estimation, grid stability analysis and generator design to comply with grid code specifications. Through extensive design optimisation different generator topologies are considered. All the operational principles of the generator are verified by means of practical tests, both in the laboratory and in the field.

SA Biomedical Engineering & Technology Conference

Prof Eugene Cloete

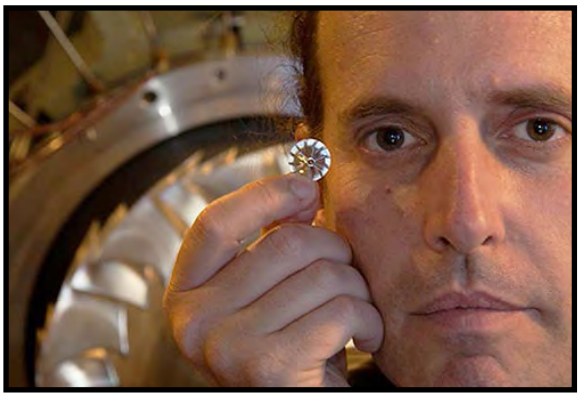
The Biomedical Engineering Research Group (BERG), which forms part of the *Department of Mechanical and Mechatronic Engineering,* hosted the first South African Biomedical Engineering & Technology Conference from 1 - 4 April this year.

According to Wayne Swart, PhD student at the department, the conference was an immense success with approximately 80 attendees from universities, research institutes and industries across the globe, including nationalities such as Germany, Serbia, the United Arab Emirates and the United States.

Prof Eugene Cloete, vice-rector of Research and Innovation, welcomed all the delegates at the conference, which was sponsored by Philips and hosted at the Wallenberg Research Centre at STIAS, Stellenbosch.

A broad scope of research topics was presented, including projects on brain imaging and neuro-signal processing, prostheses design and various diagnostic and monitoring technologies, as well as the application of biomedical technologies in sport science.

Dr Anthony Gannon wins ASME IGTI Best Paper



Dr Anthony Gannon

Dr Anthony Gannon, a former postgraduate student at the *Department of Mechanical and Mechatronic Engineering*, obtained his Masters degree in 1996 and graduated with a PhD degree from the Faculty in 2002.

Dr Gannon, who was subsequently appointed as a research associate professor at the Department of Mechanical and Aerospace Engineering (MAE) in California, USA, poses with two turbine motors of vastly different sizes at the Naval Postgraduate School (NPS) Turbomachinery Lab in California. Dr Gannon and Dr Garth Hobson were recently recognised with best paper honours by the 2014 International Gas Turbine Institute's (IGTI) Technical Conference and Exposition for their work on microturbines, turbochargers and small turbomachines.

Dr Gannon and his colleagues are working to build micro-molecular turbo pumps for high-vacuum applications such as battlefield chemical and biological detectors. They hope that improvements in micro-technology will eventually lead to the creation of a hand-held spectrometer capable of sniffing out atom-sized particles.

"We can't show you the actual size of the [micro-electrical mechanical systems] MEMS-scale turbine without the use of a scanning electron microscope," said Gannon. "The properties that act upon the turbine blade at human scale do not operate the same way in the MEMS-Scale. We discussed these results in our six-page summary paper."

The significance of this work is that this is the first simulation and design of a MEMS-Scale vacuum pump taking into account the transition region between continuum flow and free molecular flow.

Besides contributing to the development of hand-held spectrometers for the detection of biological and chemical weapons, this research has extended the capability of the numerical software for analysis and design into a flow regime were the continuum assumption starts to break down.

Dr Gannon submitted the paper at last year's Technical Conference and Exposition, which was hosted by the American Society of Mechanical Engineers (ASME). Dr Gannon presented his research findings at the 2014 Expo in June this year and received the Best Paper Award for the NPS group at that time.

We are very proud of the accomplishments of our former postgraduate students and on behalf of Prof Theo von Backström, his former promoter at the Faculty, we would like to wish Dr Gannon every success as he continues his groundbreaking research in the turbomachinery field.

Drs Anthony Gannon and Garth Hobson, with their wind-turbines in the background.

Kenny Allen obtains PhD qualification

Dr Kenny Allen

Congratulations to Kenny Allen for obtaining his PhD qualification during the April '14 graduation ceremony!

Title:	Rock bed thermal storage for concentrating solar power plants
Department:	*Department of Mechanical and Mechatronic Engineering*
Promoter:	Prof Theo von Backström
Co-promoter:	Prof Detlev Kröger

Summary:
Beds of packed rock with air as heat transfer fluid offer a potentially low-cost thermal energy storage technology for concentrating solar power plants. Rock suitability and packed bed heat transfer characteristics were investigated. Pressure drop correlations for crushed rock beds were formulated for various packing directions. A method was devised to determine optimum bed design parameters for maximum net income from a packed bed used in a power plant. A cost-estimate shows that rock beds compare favourably with molten salt energy storage. The work contributes to the understanding of rock bed characteristics, and leads towards detailed techno-economic studies on rock beds.

Ali Rugbani obtains PhD qualification

Congratulations to Ali Rugbani for obtaining his PhD qualification during the April '14 graduation ceremony!

Title:	Investigation of vision based systems for micrometrology
Department:	*Department of Mechanical and Mechatronic Engineering*
Promoter:	Prof K Schreve

Summary:
The candidate has invented a novel micro-CMM parallel kinematic manipulator. The machine is considered as a viable positioning device for micro measurement applications. It offers the advantages associated with parallel kinematic manipulators, such as light carrying weight, high stiffness and no accumulation of errors, while avoiding some of the traditional disadvantages of parallel manipulators such as the associated effects of angular errors (Abbé error), singularity problems, workspace limitation and the extensive use of spherical joints. The analytical modelling of this research has succeeded in estimating the machine accuracy, with promising results of achieving the ultimate goal of measuring 3D objects with accuracy in the submicron region.

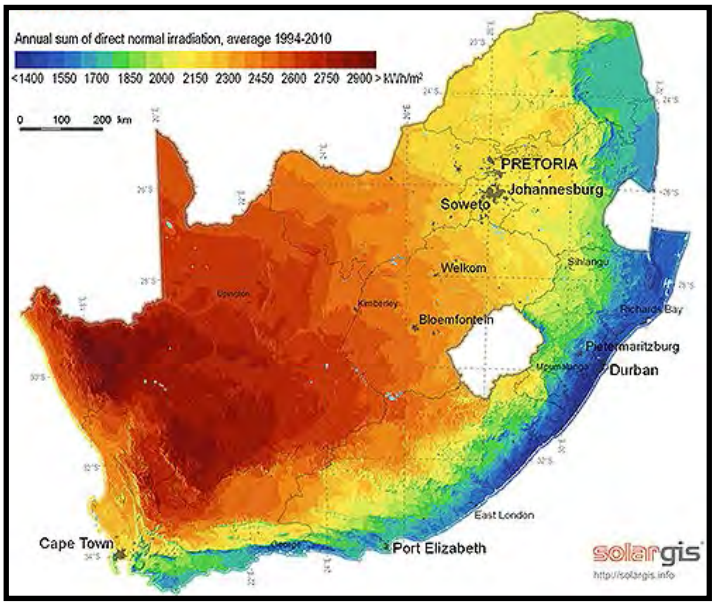
Dr Ali Rugbani, on one of his travel expeditions.

Solar Resource Data for Southern Africa

Six universities from South Africa and one each from Reunion, Botswana, and Namibia are cooperating on the Southern African Universities Radiometric Network (SAURAN). The network consists of 12 radiometric measurement stations in Southern Africa and on the island of Reunion, all equipped with high resolution instrumentation to measure the solar irradiance as well as other meteorological parameters. The data are made publically available for free download on www.sauran.net. The main purpose of making the data publically available is to promote the use of solar energy in SADC countries and to improve the quality of satellite-derived solar data available for the area.

The measurement network was initiated by the Universities of Stellenbosch and KwaZulu-Natal, which installed their radiometric stations more than four years ago. The network was further extended to Port Elizabeth, where Eskom made measurement equipment available at the Nelson Mandela Metropolitan University (NMMU). The stations in Durban were funded by Eskom, the National Research Foundation, the United States Agency for International Development (USAID) and the Norwegian University of Science and Technology, with funding support for the SAURAN initiative coming from the eThekwini Municipality, through their Energy Office. The University of Reunion is presently equipping their station in the city of Le Port through a grant from the European Union. Last year the German Government, through their agency the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), made funding available for another six stations and later another four stations may be added with funding from USAID. The GIZ funding also supported the establishment of the SAURAN website and will fund the development of a newly updated solar map of South Africa.

The purpose of placing the measured data in the public domain is to make it possible for companies and members of the public to obtain accurate, measured solar data in the areas where the stations are deployed. In addition the data will be made available to institutions who predict solar irradiance through satellite imagery to recalibrate their estimation models so that the overall quality of satellite-derived solar data will improve. At present it is possible to obtain solar data for periods of up to 20 years from some of these sources. The accuracy of these satellite-derived data sets can now be verified against the measured solar data.



Solar map of South Africa

Typical solar radiometric measurement station installed in the Karoo.

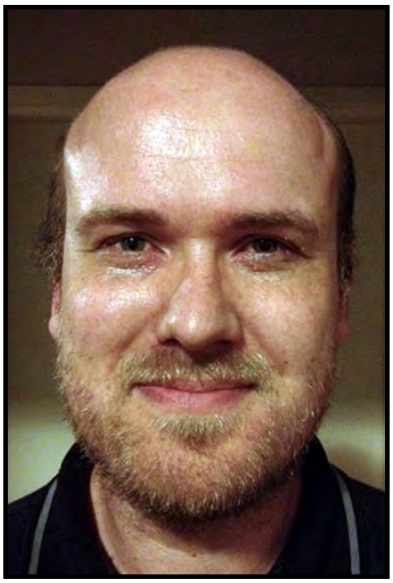
Prof Wikus van Niekerk, the Director of the Centre for Renewable and Sustainable Studies at the *Department of Mechanical and Mechatronic Engineering*, said: "This collaboration between the various Southern African universities, sponsored by Eskom, the National Research Foundation and international donor agencies (GIZ and USAID), is an excellent example of what can be achieved with relative little funding but where there is, however, goodwill and a spirit of cooperation between researchers. This SAURAN network will continue to add value to the Southern African solar energy industry and research community for many years to come."

This project, spearheaded by two of the country's leading research universities in solar energy, will complement the recently announced South African Solar Energy Atlas project of the Department of Science and Technology with the South African Weather Services, where another 12 solar radiation measurement stations will be deployed. This project was recently announced by the Deputy Minister of Science and Technology, Michael Masutha, at the launch of the Droogfontein PV installation.

In the second half of the year Stellenbosch University and the GIZ will release an updated solar map of South Africa that will be based on these and other available measured solar data sets.

Hennie de Villiers obtains PhD qualification

Congratulations to Hennie de Villiers for obtaining his PhD qualification during the April '14 graduation ceremony!



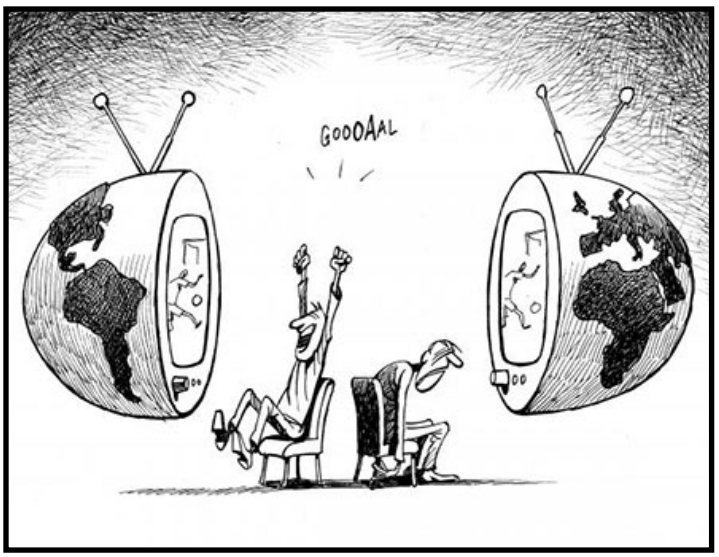
Dr Hennie de Villiers

Title: A vision-based South African sign language tutor
Department: *Department of Electrical and Electronic Engineering*
Promoter: Prof TR Niesler
Co-promoter: Prof L van Zijl

Summary:
E-tutoring systems for sign languages can contribute greatly when qualified teachers are relatively scarce. A hand tracking system using the Earth Mover's Distance is proposed and optimised for speed, and is shown to substantially improve hand pose estimation accuracy relative to existing systems. A novel graphical model is created which, through statistical reasoning, automatically performs colour calibration, a function usually performed through laborious and brittle manual intervention. Finally, a unique feedback approach is developed which uses natural language to not only describe errors made by the user, but also how they should be corrected.

Points to Ponder

Someone once said: "If you're not mad, you're not paying attention."
So if you happen to be slightly mad, a bit sad, or just plain bored, follow these tips and your life will become far more entertaining (you'll probably lose a few friends in the process, though):
1) Whenever you trip in a public place, scream "NOT AGAIN!" at the top of your lungs.
2) Once a week, walk away backward from an important conversation.
3) Whenever you hear a non-professional singer singing a song you like, ask them who sang that originally. After they tell you, respond by saying "Let's keep it that way."
4) At a fancy restaurant, ask to see the dollar menu.
5) Never refer to someone's pet as "him" or "her" in the presence of its owner. Refer to it instead as "it" or "that thing."
6) If someone tells you that you have food on your face, make a giant exaggerated gesture to remove it, on a part of your face far from the location of the food.
7) If someone touches you, tell them to warn you next time so you can flex.
8) Tell people that you studied piano for 12 years. If there is a piano nearby, sit down at it dramatically, clear your throat dramatically, wiggle your fingers dramatically, and play "Chopstix" in ill humour.
9) Go up to a stranger in the supermarket and ask them to borrow the first thing you see in their shopping trolley. If they refuse, mutter "people today" and run away.
10) End at least one non-personal phone call a month by stating flatly, "I love you."



Interference Mitigation for Square Kilometre Array

"I love it when a plan comes together!" These words, from the popular 80's television series The A-team, ring true for Prof Howard Reader and his postgraduate research group at the *Department of Electrical and Electronic Engineering,* after a very successful measurement campaign at the Square Kilometre Array (SKA) core site close to Carnarvon in the Northern Cape.

According to Dr Gideon Wiid, lecturer at the department, the goal of the campaign was to evaluate signal propagation loss in the Karoo, the shielding effectiveness of the Karoo Array Processor Building (KAPB), and the electromagnetic shielding properties of the soil berm created by the KAPB construction. Novel time and frequency domain techniques were exploited during the week-long exercise. This forms part of the department's greater involvement in SKA research, specifically on radio frequency interference (RFI) characterisation and mitigation. The postgraduate projects are all funded by the National Research Foundation (NRF) SKA SA, and by a special NRF/SKA High Performance Computing grant.

The first high frequency measurement technique used forms part of Hardie Pienaar's MEng degree on signal propagation studies for the SKA site. He used a quadcopter with specially designed antenna integrated in the landing gear. With programmed flight patterns, the quadcopter continuously measured the electric field levels around the KAPB at specific frequencies.

The second technique involved a time domain (TD) impulse approach to measure propagation loss and shielding over a wide frequency range. For his Master's programme, Nardus Matthysen designed an impulse radiating antenna (IRA) which transmits a highly directive 2.5 kV ns impulse at 1 ms intervals. The signal is received on a wideband packaged printed circuit board log-periodic dipole array (PCB-LPDA) antenna, which formed part of Dr Wiid's SKA post-doctoral work. The receiving instrument is a real-time transient analyser (RTA), which Antheun Botha helped to develop as part of his MEng degree. Using these instruments together, a frequency range of 150 MHz to 2.5 GHz was measured within a few short pulses. This significantly reduced the time it took to do wideband propagation and shielding studies as compared to conventional frequency-stepping techniques.

Calibration testing of the IRA using a packaged PCB LPDA and the real time analyser RTA3.

The SKA South Africa RFI manager, Simon Norval, who facilitated the team effort, was duly impressed with the achievements of the research and the measurement campaign as a whole. Both Simon and Carel van der Merwe, the system engineer for infrastructure, are excited about the possibilities that these measurement methods create. Their interest is in the overall RFI characterisation and mitigation strategies for MeerKAT and SKA phase 1.

The group who joined the measurement campaign on site is (at the back from left to right) Stephan Combrink, Simon Norval (SKA), Carel van der Merwe (SKA), Paul van der Merwe (MESA), Nardus Matthysen, Braam Otto (MESA); and (in the front from left to right) is Hardie Pienaar, Antheun Botha, and Gideon Wiid.

One component of the research started more than 30 years ago with Prof Reader's PhD at Cambridge on time-domain methods, where he designed a wideband nanosecond pulse generator and radiating antenna. When he joined Stellenbosch in 1994 he got involved in electromagnetic compatibility (EMC) and RFI mitigation. During the early stages of the SKA project in 2006, he was approached as part of the human capital development (HCD) program of the SKA to join the program in his capacity as an EMC and RFI specialist. He supervised the PhD and PostDoc programs of Braam Otto and Paul van der Merwe (who joined the campaign in a consulting capacity from MESA Solutions) as well as Dr Wiid, who is now an SKA-supported lecturer in the group.

Almost all the research topics of the group have been inter-related, with all students creating a stimulating and innovative group dynamic. Prof Reader has described it as the most stimulating time of his research career, with everything just coming together beautifully. He will take early retirement at the end of this year, but Dr Wiid will continue with the academic group's research on RFI mitigation for SKA.

Hardie and Nardus will finish their Masters degrees this year. In the near future, more measurement campaigns are planned to include two new MEng students, Stephan Combrink and Stanley Kuja. Their research, supervised by Dr Wiid, will consider coupling issues between MeerKAT telescopes, along with lightning protection. Another new PhD student, Temwani Phiri, will continue research on shielding and propagation under the joint supervision of Prof David Davidson, the SKA SARChI chair in the department, and Dr Wiid.

Nezmi Tezel, 'n post-doctoral fellow in the group with Profs Reader and Davidson, worked on simulations of the berm shielding, which can now be compared to measurements thanks to the whole group effort.

Thank you also to Dr Wiid for taking these lovely photographs.

Port and Coastal students at ICCE in Seoul

At this year's ASCE International Coastal Engineering Conference (ICCE) in Seoul, South Korea, two abstracts based on MEng (Research) theses studies conducted in 2013 have been accepted for presentation and subsequent publication in the proceedings. These two theses were studied within the postgraduate programme in Port and Coastal Engineering of the *Department of Civil Engineering*.

An abstract by Christiaan Seifart on the "Impacts of the Seli One Shipwreck on the Table Bay Beaches" addresses the rapid local erosion of the beaches near Bloubergstrand as a result of the stranding of the Panamanian vessel in September 2009, when the vessel ran aground in strong onshore winds.

An abstract by MScEng student Duncan Stuart has been accepted for the same conference, which presents his investigation and modelling of long wave disturbances in the Port of Ngqura in Algoa Bay, in which he is able to simulate the oscillation modes of the port and correlate these with vessel motion incidents. Duncan traveled to Seoul, Korea, in June this year to present the paper at the ICCE.

Chris Seifart undertaking beach surveys near Bloubergstrand in the lee of the Seli One shipwreck.

Climate Change focus for Coastal Engineers

The Port and Coastal Postgraduate Programme has focussed research and student thesis work on climate change in 2013 and continues to do so in 2014. The latest predictions by the Intergovernmental Panel on Climate Change (IPCC) in their Assessment Report 5, released in 2014, indicate almost double their previously published rate of sea level rise.

Research Masters student, Petronella Faasen, has been examining the potential impacts of sea level rise and storm changes on the coastal conditions at a number of sites around the Cape Town area. For Bakoven, on the Cape Peninsula, she conducted modelling to confront the sensitive embayment and its exposed waterfront housing with the changed marine conditions.

Petro specifically examined the accommodation option of the classical "Retreat, Protect or Accommodate" measures recommended in such cases by the IPCC and found that municipal and city by-laws need to adapt to enable the properties to accommodate sea level changes by raising foundations.

Beachfront housing at Bakoven, near Cape Town.

Without this flexibility from the authorities some existing properties will be in danger. Clearly new properties and developments need to be planned with full awareness of the changing conditions and higher risks. The findings were presented in February and Petro graduated in April this year.

Michelle Zamudio obtains PhD qualification

Congratulations to Michelle Zamudio for obtaining her PhD qualification during the April '14 graduation ceremony!

Dr Michelle Zamudio, looking radiant on her wedding day in 2013!

Title: The separation of detergent range alkanes and alcohol isomers with supercritical carbon dioxide
Department: *Department of Process Engineering*
Promoter: Prof JH Knoetze
Co-promoter: Dr CE Schwarz

Summary:
Process performance data are crucial when evaluating the viability of a separation process, but due to the time and costs associated with pilot plant scale experiments the use of predictive process models to generate such data are often preferred for industrial applications. In this work a working process model was established in Aspen Plus® that can be used to predict the separation performance of a supercritical fluid fractionation process. In a novel approach the model was used to prove that supercritical fluid fractionation is a feasible process to consider for the separation of mixtures of detergent range alkanes and alcohol isomers.

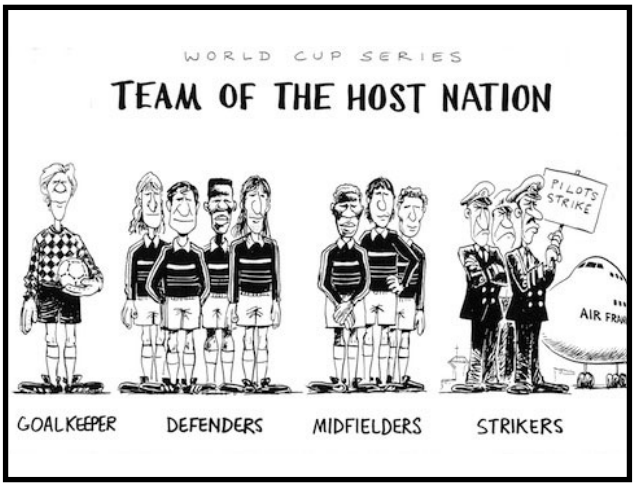
Matteo Dal Ben obtains PhD qualification

Dr Matteo Dal Ben

Congratulations to Matteo Dal Ben for obtaining his PhD qualification during the April '14 graduation ceremony!

Title: Resilient response and performance of bitumen stabilized materials incorporating reclaimed asphalt pavement
Department: *Department of Civil Engineering*
Promoter: Prof K Jenkins

Summary:
The increasing use of Bitumen Stabilised Materials (BSMs) in the world and especially in Southern Africa necessitates further research into the fundamental properties and behaviour of BSMs. The project's aim is to investigate the feasibility and suitability of producing BSMs that include reclaimed asphalt (RA) with relatively high blending ratios of recycled graded crushed stone. The findings show that the RA type and percentage influences the rutting resistance, Indirect Tensile Strength (ITS), shear properties. Resilient modulus and moisture susceptibility of the BSMs. A portion of this study is dedicated to the characterisation of the permanent deformation behaviour, moisture damage simulation and temperature distribution analysis in the BSMs.



Global Engineering Teams (GET) in Tulbagh

Agter (v.l.n.r.) is Dr Marco Eisenberg, Gus Omer, Wes Teerlink, Matthew Dion, Aaron Fleishman, Pankaj Deo, Debbie Lloyd, Eduard Kieser, en Prof Cornie Scheffer. In die middel (v.l.n.r.) is Prof Eric Ledet, Seonghwan Choi, Christiaan Homann, Lucas Paes de Melo, Isabel Bahiana, Leslie Smith, Marissa Stutzman, Bruce de Jongh, en Jessica Menold. Voor (v.l.n.r.) is Felix Dietrich, Kijung Park, en Kevin Neaves.

GET (Global Engineering Teams) is 'n globale universiteitskursus wat aangebied word deur die Department of Assembly Technology and Factory Management by die Technische Universität in Berlyn. Prof Cornie Scheffer van die *Departement Meganiese en Megatroniese Ingenieurswese* is die Suid-Afrikaanse medewerker vir die Global Engineering Teams (GET) kursus. GET is 'n innoverende ingenieurswese opvoedkundige kursus met die volgende hoof doelstellings:
1) die oplossing van ingenieurswese take in internasionale groepe wat bestaan uit studente van beide ontwikkelende en reeds ontwikkelde lande; 2) interdissiplinêre projek-georiënteerde werk gebaseer op die idee van "leer deur doen"; en 3) holistiese benadering as 'n bydrae tot globale volhoubaarheid, inaggenome die ingenieurswese take onder ekonomiese, ekologiese en sosio-politieke aspekte.
Studente van die Universiteite van Stellenbosch, Penn State, Gyeongsang en Berlyn, asook die Hasso Plattner Institute Postdam en Rensselaer Polytechnic Institute, het gedurende die eerste week in Maart vanjaar by Waterval Lodge in Tulbagh bymekaargekom vir die afskop-vergadering vir Global Engineering Teams (GET) 2014.
Gedurende hierdie week het die spanlede mekaar, en hul projekte, leer ken met behulp van geesdriftige spanbou-aktiwiteite en verskeie "design thinking" projekte. Die projekte is ontwerp sodat dit van toepassing is op die verskeie organisasies wat die projekte befonds. Sosiale gebeure gedurende hierdie week sluit in aksies soos "paintball", Afrika dromme, en verskeie staproetes.
Daar is verskeie mylpale gedurende die jaar wat verseker dat die nodige aandag aan die projekte geskenk word. Hierdie mylpale word deurlopend geëvalueer deur die onderskeie toesighouers van die bogenoemde universiteite. Die sluitingsdatum vir die 2014 GET-program is in die eerste week van Oktober, waartydens al die lede in Amerika sal vergader om hulle finale projek-resultate voor te stel.

LJ du Preez obtains PhD qualification

Congratulations to LJ du Preez for obtaining his PhD qualification during the April '14 graduation ceremony!

Dr LJ du Preez

Title: Reactive absorption kinetics of CO_2 in alcoholic solutions of MEA: fundamental knowledge for determining effective interfacial mass transfer area
Department: *Department of Process Engineering*
Promoter: Prof JH Knoetze
Co-promoter: Dr LH Callanan

Summary:
The reactive absorption of carbon dioxide into alcoholic solutions of mono-ethanolamine is a viable method for measuring effective interfacial mass transfer area of separation column internals. Knowledge of the liquid phase reaction kinetics is of great importance in order to improve on the accuracy of effective area measurements. A novel in-situ Fourier transform infrared method of analysis was developed and used to study the homogeneous liquid phase reaction kinetics of CO_2 with MEA in alcoholic solvents. New fundamentally derived rate expressions were developed for use in a numerical, rate based method to calculate effective area from absorption rate data.

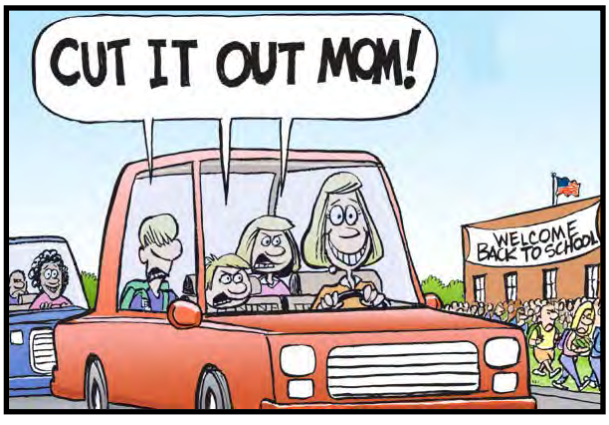
Mohsen Karimi obtains PhD qualification

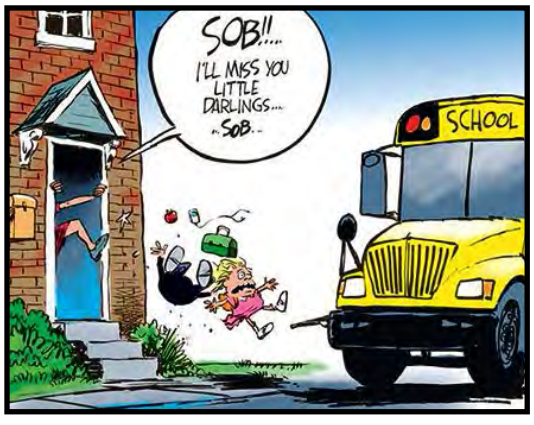
Dr Mohsen Karimi

Congratulations to Mohsen Karimi for obtaining his PhD qualification during the April '14 graduation ceremony!

Title: CFD analysis of solid-liquid-gas interactions in flotation vessels
Department: *Department of Process Engineering*
Promoter: Prof G Akdogan
Co-promoter: Prof SM Bradshaw

Summary:
A Computational Fluid Dynamics (CFD) model was developed for the prediction of flotation rate constants. After beginning with the single-phase modelling based on the solutions of the continuity and momentum balance equations the modelling framework was extended to include the gas-liquid interactions. The time-varying values of the turbulent flow field were then incorporated into a kinetic model of flotation. The final CFD-kinetic model was evaluated for the flotation of quartz and galena particles at different operational conditions which resulted in good agreement between the numerical predictions and experimental data. The new model was found to be suitable for the flotation modelling and optimization practices.





Postgraduate Research Seminar 2014

The *Department of Process Engineering* held its annual Postgraduate Research Seminar from 29 - 30 May, with PhD student Frank Nsaful as chair of the organising committee. Over the years, this seminar has become an excellent platform for students in which to exchange comments and experience. Prof Andre Burger, departmental chair, emphasized in the welcoming address the importance of sharing and questioning knowledge in the development of research.

The two-day programme included oral and snapshot presentations, which offered an excellent review of the main research themes in the department (Process Monitoring and Systems, Mineral Processing, Separation Technology and Bioprocess Engineering). Postgraduate students presented their individual research topics, which covered a broad range of topics related to the chemical, mineral, biochemical and environmental industrial sectors, to an attentive audience. The audience appreciated, in particular, the important contribution that the department has made with regards to developing student capabilities to better understand and predict process performance.

Prizes for the best full oral presentations and snapshots were allocated by postdoctoral fellows and awarded by Prof Kim Clarke, the department's academic postgraduate coordinator. Congratulations to the following prize winners!

From left to right: Waylin Peddie, Neo Motang, Angelo Ridout, Jason Smit, Sonja Boshoff, and Wim Diederichs

Full oral presentations: first place went to Angelo Ridout, Neo Motang was awarded second place and Sonja Boshoff walked away with third place.

Snapshots: first place went to Waylin Peddie, Jason Smit was awarded second place and Wim Diederichs walked away with third place.

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