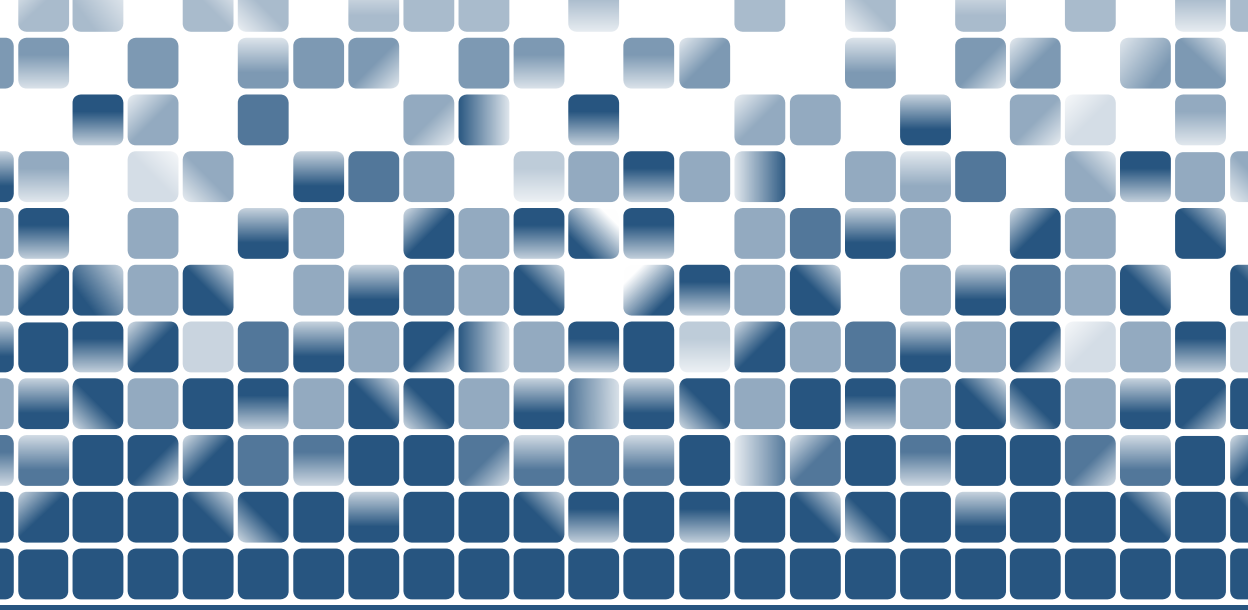


Fakulteit Ingenieurswese
JAARVERSLAG

2015

Faculty of Engineering
ANNUAL REPORT

Inhoud Contents

Algemene oorsig

Van links: Dr Moira Bladergroen (gemengde leer koördineerder) en Inez Saunders (opvoedkundige sielkundige).

From the left: Dr Moira Bladergroen (Blended Learning Coordinator) and Inez Sauders (Educational Psychologist).

Voortgesette groei

Die Fakulteit Ingenieurswese het die afgelope agt jaar beduidend gegroei ten einde die Universiteit van Stellenbosch (US) in staat te stel om die reuse tekort aan ingenieurs in Suid-Afrika te probeer verlig. Groei het in 2015 voortgeduur met die eerstejaarsinname asook die aantal nagraadse graduati wat steeds gestyg het. Die 39 PhD- en 224 meestersgraad-toekennings – 'n stewige 35%- en 36%-toename onderskeidelik – het die Fakulteit se navorsingseenhede ook beduidend laat groei.

Ingenieurswese is die fakulteit vir wetenskap, ingenieurswese en tegnologie met die hoogste kontaktyd en krediete aan die US. Met die gepaardgaande toename in studente lei dit tot 'n baie hoë student:dosent-verhouding. Heelwat nuwe akademici is in 2015 aangestel om die veeleisende lading op dosente te probeer verlig.

Verbeterde aanbieding en ondersteuning

Die toename in studente, die groot vooruitgang op die gebied van nuwe tegnologie en die behoefte om goed-afgeronde ingenieurs te lewer, het die Fakulteit inspireer om nuwe metodes vir die oordra van inligting te ontwikkel. Die afgelope jaar is groter klem op die aanwending van inligting- en kommunikasietegnologie (IKT) geplaas en het die Fakulteit op hierdie gebied die voortou by die US geneem. 'n Koördineerder vir gemengde leer, dr Moira Bladergroen, is aangestel en ongeveer 16 projekte is geloods waarby 30 dosente en assistente betrokke was. Met dié benadering hoop die Fakulteit om dosente se produktiwiteit, in die konteks van groter klasse en die hoë student:dosent-verhouding, te verbeter, asook om studente se produktiwiteit en studiesukses te verhoog deur groter gebruik van tegnologie. Die strategie maak ruim gebruik van video's om byvoorbeeld studente vir praktika voor te berei, om probleemoplossing te verduidelik en om hersiening te vergemaklik.

Ingenieurstudie is veeleisend en uitdagend. Daarom het die Fakulteit oor die jare verskeie hulpmiddels ingestel om studente te ondersteun, soos die Tutorprogram wat sedert 2004 bykomende akademiese hulp verleen aan eerstejaars wat met tegniese vakke sukkel. Vanaf April 2015 kon Matie-ingenieurstudente boonop vir hulp oor akademiese en persoonlike uitdagings gaan aanklop by 'n opvoedkundige sielkundige, Inez Saunders, wat deeltyds by die Fakulteit aangestel is.

Infrastruktuur hoog op die agenda

Die stewige groei die afgelope agt jaar is ook een van die redes waarom infrastruktuur in 2015 hoog op die agenda was. Bouwerk aan 'n moderne, doelgemaakte Studiesentrum het in die middel van die jaar begin. Die westelike vleuel van die parkeerterrein onder die Algemene Ingenieursgebou is vindingryk ingerig in nuttige areas waar studente in stilte op hul eie kan werk of ontspan, óf in groepsverband kan werk in aansluiting by die ECSA-uitkoms wat dit van ingenieurstudente vereis. Die Studiesentrum bestaan uit groepswerkkamers, rekenaarterminale, individuele werkstasies asook 'n informele sit- en geselsarea. Bouwerk aan 'n groter en doeltreffender kafeteria in die oostelike vleuel sal in 2016 'n aanvang neem.

Die bouprojek is slegs een van vele by Ingenieurswese. Hierna word die Inligtingstegnologiegebou opgeknap en ingerig vir gebruik deur die Fakulteit Ingenieurswese wat 'n groot behoefte aan ekstra spasie het. Dan volg opknapping van lesingsale en badkamers, inrigting van nuwe lesingsale, asook 'n algemene opknapping en verdigting van die hele Ingenieurswesegebouekompleks wat byna 'n halfeeu oud is en baie aandag vereis veral met betrekking tot die nakoming van moderne veiligheidspesifikasies.

Bedreigings

Die Fakulteit is uiters bekommerd oor die welwees van sy personeel wat as gevolg van oorlading oor jare geknou is. 'n Eksterne opname toon beduidende aanduidings van uitbranding onder akademici, veral ten opsigte van emosionele uitputting wat met 'n hoë werklas geassosieer word en na personeel se persoonlike lewe deurspoel. Tweedens bedreig die lae ekonomiese groeikoers (veral in mynbou) op die lang termyn die Fakulteit se derdegeldstroominkomste. Geen verhoging in klasgelde kan ook die lewensvatbaarheid van ingenieurs se opleiding negatief beïnvloed, veral in die lig van die gebrekkige staatsubsidie wat aan ingenieursfakulteite toegeken word. 'n Spesiale veldtog om skenkersgeld te ontgin, is in Oktober geloods toe verskeie ingenieurs in senior posisies na 'n eerste gespreksgeleentheid in Gauteng genooi is.

Vooruitskouing

Ten spyte van vele uitdagings is die Fakulteit Ingenieurswese vasberade om ten volle in te speel op die US se Visie 2030.

General review

Continued growth

Over the past eight years, the Faculty of Engineering grew significantly in an effort by Stellenbosch University (SU) to reduce the dire shortage of engineers in South Africa. Growth continued in 2015 with first-year intake and graduate figures rising steadily. The award of 39 PhDs and 224 master's degrees, representing a solid 35% and 36% increase respectively, resulted in notable growth in the Faculty's research units.

Engineering is the faculty of science, engineering and technology with the highest contact time and credits at SU. This, together with increases in student numbers, led to a high student:lecturer ratio. In 2015 considerably more new academics were appointed to lighten the demanding workload of lecturers.

Improved offering and support

The increase in student numbers, massive advances in the field of new technology and the pressing need to provide well-rounded engineers, further inspired the Faculty to develop new methods of conveying information. To this end, over the past year greater emphasis was placed on applying information and communication technology (ICT), with Engineering becoming trendsetters in this field at SU. A coordinator for blended learning, Dr Moira Bladergroen, was appointed, while 16 projects were launched involving 30 lecturers and assistants. The Faculty followed this approach with the hope not only to increase lecturers' productivity in the context of larger classes and a higher student:lecturer ratio, but also to improve students' productivity and study successes through greater use of technology. The strategy relied heavily on videos to prepare students for practical work, explain problem solving and facilitate revision work.

Engineering is a demanding and challenging field of study. Over the years the Faculty introduced various aids to provide student support, such as the Tutor Programme, introduced in 2004, that provides academic assistance to first-year students who grapple with technical subjects. Since April 2015, Maties engineering students with academic and personal challenges can consult an educational psychologist, Inez Saunders, who was appointed in the Faculty on a part-time basis.

Infrastructure high on the agenda

The steady growth the past eight years was one of the reasons why infrastructure was high on the agenda in 2015. Building work commenced on a modern, purpose-built Study Centre towards the middle of the year. Ingenious ways were found to convert the west wing of the parking area underneath the General Engineering Building into functional areas where students can work or relax quietly on their own, or work in groups, in accordance with the required ECSA outcome for students. The Study Centre comprises rooms for group work, computer terminals, individual workstations, as well as an informal lounging and chat area. Building work will commence on a larger more efficient cafeteria at the east wing in 2016.

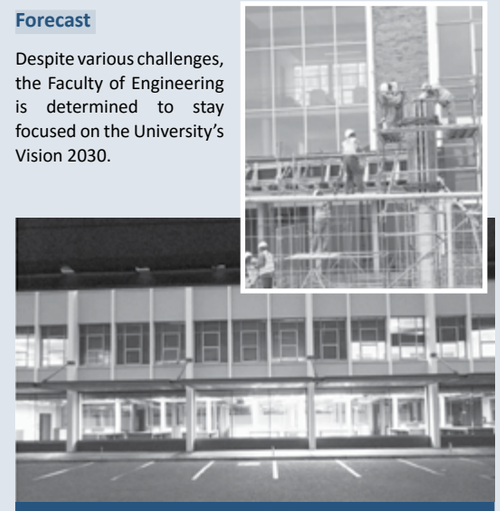
This building project is only one of many at Engineering. The Information Technology building is scheduled for renovation and refurbishment for use by Engineering that has a critical need for additional space. The renovation of lecture halls and bathrooms, the refurbishing of new lecture halls, and general renovations and densification of the Engineering Building Complex are also on the cards as this complex is almost fifty years old and requires a lot of attention, especially in terms of meeting modern safety requirements.

Threats

The Faculty is deeply concerned about the wellness of its staff whose work overload over the years has taken a toll. An external survey found significant signs of burnout among academics, while emotional exhaustion prompted by heavy workloads had a ripple effect on their personal lives. Secondly, the low economic growth rate (particularly in the mining sector) will have a negative impact on the Faculty's third-stream income over the long term. In addition, zero increases in class fees will negatively affect the viability of engineering training, especially in the context of insufficient state subsidies for engineering faculties. A special campaign to explore donor funding was introduced in October when various engineers in senior positions were invited to a discussion forum in Gauteng.

Forecast

Despite various challenges, the Faculty of Engineering is determined to stay focused on the University's Vision 2030.



Die Studiesentrum in aanbou (bo) en nader voltooiing (onder).

The Study Centre under construction (top) and nearing completion (bottom).

Organigram | Organogram

Dekaan
Dean
Prof Hansie Knoetze | engdean@sun.ac.za

Visedekaan (Navorsing)
Vice-Dean (Research)
Prof Willie Perold | wjperold@sun.ac.za

Visedekaan (Onderrig en Gehalteversekering)
Vice-Dean (Teaching and Quality Assurance)
Prof Anton Basson | ahb@sun.ac.za

Departement Bedryfsingenieurswese
Department of Industrial Engineering
Prof Corne Schutte | corne@sun.ac.za

Instituut vir Bedryfsingenieurswese
Institute for Industrial Engineering
Mnr/Mr Konrad von Leipzig | kvl@sun.ac.za

Departement Elektriese en Elektroniese Ingenieurswese
Department of Electrical and Electronic Engineering
Prof Maarten Kamper | kamper@sun.ac.za

Sentrum vir Elektriese en Elektroniese Ingenieurswese
Centre for Electrical and Electronic Engineering
Prof Johan du Preez | dupreez@sun.ac.za

Departement Meganiese en Megatroniese Ingenieurswese
Department of Mechanical and Mechatronic Engineering
Prof Kristiaan Schreve | kschreve@sun.ac.za

Instituut vir Termodinamika en Meganika
Institute for Thermodynamics and Mechanics
Prof Christiaan Meyer | cjmeyer@sun.ac.za

Departement Prosesingenieurswese
Department of Process Engineering
Prof Steven Bradshaw | smb@sun.ac.za

Sentrum vir Prosesingenieurswese
Centre for Process Engineering
Prof Johann Görgens | jgorgens@sun.ac.za

Departement Siviele Ingenieurswese
Department of Civil Engineering
Prof Kobus du Plessis | jadup@sun.ac.za

Sentrum vir Siviele Ingenieurswese
Centre for Civil Engineering
Prof Kobus du Plessis | jadup@sun.ac.za

Dekaanskantoor | Office of the Dean

Prof Hansie Knoetze
Dekaan
Dean
engdean@sun.ac.za

Prof Willie Perold
Visedekaan (Navorsing)
Vice-Dean (Research)
wjperold@sun.ac.za

Prof Anton Basson
Visedekaan (Onderrig en Gehalteversekering)
Vice-Dean (Teaching and Quality Assurance)
ahb@sun.ac.za

Mnr/Mr Enzo D'Aguanno
Fakulteitsbestuurder
Faculty Manager
vsd@sun.ac.za

Mev/Mrs Nicole Hartzenburg
Fakulteitsekretaris
Faculty Secretary
nicolepa@sun.ac.za

Mnr/Mr Minnaar Pienaar
Fakulteitsbeampte
Faculty Officer
mop@sun.ac.za

Me/Ms Liesel Koch
Korporatiewe Bemarker
Corporate Marketer
lkoch@sun.ac.za

Me/Ms Tanya Ficker
Nagraadse Koördineerder
Postgraduate Coordinator
tanya@sun.ac.za

Mev/Mrs Avril Ford
Administratiewe Beampte
Administrative Officer
aford@sun.ac.za

Me/Ms Marilie Oberholzer
Persoonlike Assistent: Dekaan
Personal Assistant: Dean
marilie@sun.ac.za

Me/Ms Portia Adonis
Administratiewe Assistent en Ontvangs
Administrative Assistant and Reception
portiaadonis@sun.ac.za

Mnr/Mr Ulrich Smith
Tegniese Beampte
Technical Officer
ubsmith@sun.ac.za

Research Output

	Industrial	Electrical & Electronic	Mechanical & Mechatronic	Process	Civil	Total
Journal articles (subsidised)	29	30	25	50	16	150
Journal articles (Non-subsidised)	3		7		2	12
Proceedings (International)	42	87	23	6	43	201
Proceedings (National)	11	13	28		2	54
Books	1					1
Chapters in Books	4	3				7
Patents		6				6
Reports					4	4
Doctoral completed	3	9	5	8	14	39
Master's completed	48	45	37	25	69	224

DEPARTEMENT
BEDRYFSINGENIEURSWESE

DEPARTMENT OF
INDUSTRIAL ENGINEERING

5 HOOGTEPUNTE

'n Indrukwekkende versameling voorpunttegnologie in die Stellenbosch Tegnologiesentrum – Laboratorium vir Gevorderde Vervaardiging.

An impressive collection of cutting-edge technology in the Stellenbosch Technology Centre – Laboratory for Advanced Manufacturing.

Moderne navorsingsfasiliteit

'n Moderne fasiliteit met 'n indrukwekkende versameling toerusting op die gebied van gevorderde vervaardiging is oor die afgelope tien jaar opgebou. Die Stellenbosch Tegnologiesentrum – Laboratorium vir Gevorderde Vervaardiging (STC-LAM) spog met voorpunttegnologie vir navorsing in vervaardigingsingenieurswese. Dit verskaf 'n basis vir gevorderde opleiding, toegepaste navorsing en ontwikkeling, en tegnologieoordrag aan industrie. Die Sentrum, wat vanuit die Instituut vir Gevorderde Gereedskap (IAT) by die Universiteit van Stellenbosch (US) ontstaan het, is moontlik gemaak deur jarelange ondersteuning en kernbefondsing deur staatsdepartemente, soos wat van die Departement Wetenskap en Tegnologie, en die Departement Handel en Nywerheid ontvang is, asook van vennote en organisasies soos die Tegnologie-innovasie-agentskap (TIA), die National Tooling Initiative Programme (NTIP), en die THRIP-inisiatief soos geadministreer deur die Nasionale Navorsingstigting.

Leerfabriek opgerig

Die ontwikkeling van 'n Leerfabriek (Learning Factory) is in 2015 van stapel gestuur omdat die Departement die belang en potensiaal van sodanige hulpmiddel besef het. Aanvanklike infrastruktuur soos werkstasies, stoorrakke en toerusting vir die aanmekaarsit van modeltreintjies is opgerig. Die ontwikkeling van voorgraadse opleidingmodules (in areas soos Ergonomika, Produksiebestuur en Vervaardigingstelsels) is ook inisieer. Die Leerfabriek word tans uitgebrei om addisionele tegnologie en toerusting in te sluit vir geoutomatiseerde produksieselle, volg en opsporing van onderdele en voorraad, asook visuele hulpmiddels vir bestuur. Hierdie belangrike inisiatief sal voorgraadse studente in staat stel om die kennis wat hulle verwerf het in 'n visuele en aantreklike wyse toe te pas wat op die ou einde die leerervaring en voorgraadse aanbod van die Departement sal verbeter en versterk.

Internasionale ervaring opgedoen

Nege meestersgraadstudente het 'n Somerskool oor Leerfabrieke in Duitsland bygewoon waar leer deur middel van doen bewerkstellig is. Studente moes dus take verrig waar hulle te staan gekom het teen werklike uitdagings wat in die wêreld voorkom en waarvoor hulle akademiese oplossings moes vind. Alhoewel hierdie konsep lyk na 'n probeer-en-trefbenadering, ontwikkel die leerders se probleemoplossingsvermoë vinnig sodra hulle die basiese reëls verstaan. In die Leerfabriekomgewing begin die deelnemer onder en vorder deur die vlakke van leer, net soos met 'n speletjie. Deelnemers kry ook vele "lewens", want in die gesimuleerde werklike wêreld moet foute begaan word om te kan leer, itereer en verbeter. Die stelsel is daarom só ontwerp dat dit foute toelaat terwyl dit nog steeds veiligheid in gedagte hou.

SUnORE beleef goeie jaar

In 2015 het die Stellenbosch Eenheid vir Operasionele Navorsing in Ingenieurswese (SUnORE) uit 25 navorsingstudente bestaan met Danie Lötter en prof Jan van Vuuren aan die hoof. Die Eenheid het voortgegaan om uit te blink in navorsingsareas soos verkeersvloeisimulasie, voertuig roetering, grafiek en netwerkteorie, sowel as gespesialiseerde besluitnemingsondersteuning vir Armscor, Eskom, die Atoomenergiekorporasie van Suid-Afrika, en verskeie plaaslike kleinhandelaars en nie-regeringsorganisasies. Samewerking is bewerkstellig met verskeie internasionale navorsingsgroepe in Europa en die Verenigde Koninkryk, en 'n hele paar van die Eenheid se lede dien op die nasionale uitvoerende komitee van die Operasionele Navorsingsvereniging van Suid-Afrika. 2015 was 'n besonder produktiewe jaar vir die Eenheid ten opsigte van erkende navorsingsuitsette, internasionale deelname aan konferensies en die ontvang van besoekers van Kanada, die Verenigde Koninkryk en Italië vir werksessies en navorsingsamewerking.

Beduidende nagraadse groei

Die nagraadse programme in Bedryfsingenieurswese en Ingenieursbestuur het die afgelope drie jaar beduidend gegroei. In 2013 het 'n totaal van 32 studente vir die meestersgraad in Bedryfsingenieurswese en 45 vir die meestersgraad in Ingenieursbestuur registreer en het 10 en 12 studente in die onderskeie graadprogramme gradueer. In 2015 het hierdie getalle verdubbel met 20 en 29 studente wat onderskeidelik in dié programme gradueer het. Ten opsigte van PhD-grade het drie studente in 2015 hul doktorsgraad verwerf in vergelyking met een in 2013. Die Departement Bedryfsingenieurswese is ook in die proses om 'n aparte PhD-program in Ingenieursbestuur te registreer in reaksie op markvereiste.

5 HIGHLIGHTS

Modern research facility

A modern research facility with an impressive collection of equipment in the field of advanced manufacturing has been put together over the past ten years. The Stellenbosch Technology Centre – Laboratory for Advanced Manufacturing (STC-LAM) boasts cutting-edge technology for manufacturing engineering research. It provides the base for advanced training, applied research and development, and technology transfer to industry. The Centre, which originated from the Institute for Advanced Tooling (IAT) at Stellenbosch University (SU), was made possible owing to support and core funding contributions from government departments such as Science and Technology, and Trade and Industry, partners and organisations such as the Technology Innovation Agency (TIA), the National Tooling Initiative Programme (NTIP), and the THRIP initiative as administered by the National Research Foundation.

Learning factory initiated

Realising the potential of Learning Factories as an important learning tool, the Department initiated the development of one in 2015. Initial infrastructure in the form of manual assembly workstations as well as storage racks and storage equipment has been implemented for assembling model trains. The development of undergraduate training modules (in areas such as Ergonomics, Production Management and Manufacturing Systems) has also been initiated. The Learning Factory is currently being expanded with additional technologies and equipment to allow automated production cells, tracking and tracing of parts and inventory, as well as visual management tools. This important initiative will enable undergraduate students to apply the knowledge gained in a very visible and attractive manner, which will enhance the learning experience as well as the Department's undergraduate training offering.

International experience gained

Nine master's students attended a Summer School in Germany on Learning Factories where learning was achieved by doing. Students therefore had to perform tasks where they were faced with real-world challenges, for which they had to find solutions in the academic world. Although this concept seems like trial and error, once the basic rules are understood, the problem-solving abilities of the learners develop quickly. In the Learning Factory environment, a participant starts at the bottom and progresses through the levels of learning, like in a game. Participants also get many "lives" as in this simulated real world mistakes have to be made in order to learn, iterate and improve. The system is therefore designed to allow mistakes, whilst keeping safety in mind.

SUnORE has productive year

In 2015, the Stellenbosch Unit for Operations Research in Engineering (SUnORE) consisted of 25 research students headed by Danie Lötter and Prof Jan van Vuuren. The Unit continued to excel in areas of research covering traffic flow simulation, vehicle routing, graph and network theory, as well as specialised decision support for Armscor, Eskom, the Nuclear Energy Corporation of South Africa, and various local retailers and non-governmental organisations. Collaboration was established with various international research groups in Europe and the United Kingdom, and a number of the Unit's members serve on the national executive of the Operations Research Society of South Africa. 2015 was a particularly productive year for the Unit in terms of recognised research outputs, international conference participation and the hosting of visitors from Canada, the United Kingdom and Italy for workshops and research collaboration.

Postgraduate growth significant

The postgraduate programmes in Industrial Engineering and Engineering Management have seen significant growth over the past three years. In 2013 a total of 32 students were registered for the master's in Industrial Engineering, and 45 students for the master's in Engineering Management. In that year, 10 and 12 students graduated for the two degrees respectively. In 2015, this doubled to 20 and 29 students who graduated for the two degrees respectively. With respect to PhDs, three students graduated in 2015 compared to one in 2013. The Department of Industrial Engineering is now in the process of registering a separate PhD programme in Engineering Management, in response to the market demand.

Die Somerskool oor Leerfabrieke in Duitsland.

The Summer School on Learning Factories in Germany.

FOCUS

The Health Systems Engineering and Innovation Hub

The Health Systems Engineering and Innovation research group with Imke de Kock far right and Dr Sara Grobbelaar next to her.

Insert: Louzanne Bam.

GlaxoSmithKline (GSK), a prominent global player in the pharmaceutical industry, has entered into a grant agreement with Stellenbosch University's Department of Industrial Engineering to establish the Health Systems Engineering and Innovation Hub (HSE&IH). Through the generous support from GSK in the form of a seed fund, the envisioned development of a Health Systems Engineering Innovation Hub will take place over a ten-year period. The unit will aim to develop professional, trans-disciplinary relationships and links with other research and policy networks. The geographical focus of the unit will be on Public Health Systems in sub-Saharan Africa with an ultimate long-term aim to train health systems engineering and innovation specialists for the continent.

The vision for establishing a HSE&IH is to develop research capacity and capacity in practitioners to support healthcare management decision making, and to support the implementation and operationalisation of such decisions through the design and development of eHealth solutions, innovation platforms, supply chain networks, service delivery networks, information management, change management, project management and other industrial engineering knowledge areas.

The immediate support for 2016 provided by GSK is seven fully-funded master's students, covering living expenses, fees, travel funding as well as project and field work expenses. The seed fund also includes the buy-out of academic time and conference support for three lecturers (Louzanne Bam, Imke de Kock and Dr Sara Grobbelaar).

The HSE&IH is working hard towards developing enduring relationships with industry and government partners. Over the next ten years the unit will aim to solidly engrain itself in the Health Systems landscape. The initial focus areas of the unit will be on:

- *Supply and distribution:* In this research area it will be considered how the effectiveness and efficiency of supply chains and distribution networks can be improved to get the necessary resources, medicines and treatments to healthcare facilities and people;
- *Infrastructure and delivery network design:* How can it be ensured that the right kind of infrastructure and delivery network design is put in place and how can it be ensured that this is sustainable;
- *Operations:* How can healthcare delivery operations be improved to increase effectiveness and efficiency with the ultimate goal of improved utilisation of finite resources to improve access;
- *Technology transfer and innovation:* How can innovations be developed and utilised and technologies adopted to reduce healthcare costs and how can access to primary healthcare be facilitated and improved;
- *Healthcare policy and finance:* How can the design of government policies and support mechanisms be considered to improve access to primary healthcare in Southern Africa.

RESEARCH THEMES

Industrial engineering is a discipline that focuses on the integration and optimal utilisation of all of the resources of an enterprise to improve the competitiveness and sustainability, of the enterprise, and the economy as a whole. The postgraduate programme is divided into Industrial Engineering, and Engineering Management, and the Department then focuses on the following research areas:

Engineering Management

Engineering management includes fields such as project management, risk management, quality management, performance management, and feasibility studies in the wider sense.

Enterprise Engineering

Enterprise engineering analyses enterprises, and how to design, implement and operate them. It includes knowledge and information management, financial management, and technology management.

Health Systems Engineering

Health systems engineering is concerned with the optimisation of health systems and processes, to solve problems in the healthcare sector.

Inclusive Innovation and Development

The research programme focuses on the analysis and development of inclusive innovations, innovation systems and industry, based on the application of industrial engineering knowledge areas for socioeconomic development.

Manufacturing

The area focuses on resource efficient techniques that improve manufacturing processes and systems, but also for wider application in the services sector.

Physical Asset Management

Physical asset management is defined as the systematic and coordinated activities and practices through which an organisation optimally and sustainably manages its assets and related systems.

PRASA Engineering Research Chair

The PRASA Chair initiates and executes research into aspects of maintenance management, maintenance processes and applicable engineering principles best suited for the rail sector.

Supply Chain Management

Supply chain management includes fields such as supply network design, performance management, and feasibility studies in the wider sense, to contribute to efficient supply chains.

Sustainable systems

The research area focuses on the transition to a more sustainable economy and society, which will place an emphasis on the management of infrastructure and technology, including the planning and design thereof.

Systems Modelling, Operations Research and Decision Support

The research area focuses on the design and implementation of mathematical and statistical modelling techniques in support of effective decision-making in industry.

Laboratories

The Department maintains a number of in-house laboratories, including:

- Stellenbosch Technology Centre – Laboratory for Advanced Manufacturing (STC-LAM)
- Two laboratories with advanced computer and CAD facilities
- The Centre for Advanced Manufacturing (SENROB)
- Machining Laboratory
- Micromanufacturing Laboratory
- Metrology (reverse engineering) Laboratory

Chairperson
Prof Corne Schutte
ENTERPRISE ENGINEERING: Knowledge management; Innovation; Enterprise life-cycles. PROJECT MANAGEMENT: Project, programme, risk and communication management; PMBOK. OPERATIONS RESEARCH: Decision theory; Quality systems.
corne@sun.ac.za

Prof André van der Merwe
MANUFACTURING: Ergonomics; Automation; Project management.
andrevdm@sun.ac.za

Prof Neels Fourie
PRASA Engineering Research Chair. PROJECT MANAGEMENT: Strategic project management; Programme management; Project risk analysis; Risk management; Rail engineering.
cjf@sun.ac.za

Prof Dimitri Dimitrov
MANUFACTURING: Manufacturing systems; Reverse engineering; Rapid prototyping.
dimitrov@sun.ac.za

Prof Jan van Vuuren
OPERATIONS RESEARCH: Combinatorial optimisation; Vehicle routing; Scheduling and timetabling; Facility location; Decision support systems; Graph and network theory.
vuuren@sun.ac.za

Prof Alan Brent
ENGINEERING MANAGEMENT: Technology management; Decision-analysis; Life-cycle management. SUSTAINABLE SYSTEMS: System dynamics; Systems analysis; Sustainability science.
acb@sun.ac.za

Prof James Bekker
OPERATIONAL SYSTEMS DESIGN: Information systems; Computer simulation; Multi-objective optimisation.
jb2@sun.ac.za

Dr Stephen Matope
INDUSTRIAL MANAGEMENT: Production management; Robotics; Micromanufacturing.
smatope@sun.ac.za

Dr Louis Louw
ENTERPRISE ENGINEERING: Enterprise design/Re-design; Enterprise/Business modelling; Enterprise architecture; Business analysis; Knowledge management; Innovation management.
louisl@sun.ac.za

Dr Wyhan Jooste
PHYSICAL ASSET MANAGEMENT: Maintenance management; Reliability engineering; Asset management methodologies; New product-service development; Business process re-engineering.
wyhan@sun.ac.za

Dr Tiaan Oosthuizen
MANUFACTURING: Resource efficient process chains; Rapid product development.
tiaan@sun.ac.za

Mr Konrad von Leipzig
ENGINEERING MANAGEMENT: Engineering management; Strategic operations management; Supply chains; Engineering economics and finances; Clustering and business modelling.
kvl@sun.ac.za

Mr Joubert van Eeden
SUPPLY CHAIN AND LOGISTICS MANAGEMENT: Supply chain analysis; Transport modelling; Intermodal transport. PROJECT MANAGEMENT: Project management; Project office management; PMBOK.
jveeden@sun.ac.za

Mr Theuns Dirkse van Schalkwyk
MANUFACTURING AND SUSTAINABLE PRACTICES: Micromanufacturing; Sustainable energy; Scheduling; Quality assurance.
theuns@sun.ac.za

Mrs Louzanne Bam
HEALTH SYSTEMS MANAGEMENT: Operations research; Business process re-engineering; Simulation; Facility design; Project management; Operations management; Workforce planning.
louzanne@sun.ac.za

Dr Sara Grobbelaar
INCLUSIVE INNOVATION AND DEVELOPMENT: Health Systems Engineering and Innovation; Traditional and inclusive innovation systems.
ssgrobbelaar@sun.ac.za

Mr Denzil Kennon
ENTERPRISE ENGINEERING: Enterprise (re)design and modelling. ENGINEERING MANAGEMENT: Strategic- and operations (process) management; Economics and finances; Project and risk management.
dkennon@sun.ac.za

Mr Wouter Bam
VALUE CAPTURE SYSTEMS: Mineral economics; Global value chains; Sustainability assessment; Inclusive innovation; Global production networks; Business process design.
wouterb@sun.ac.za

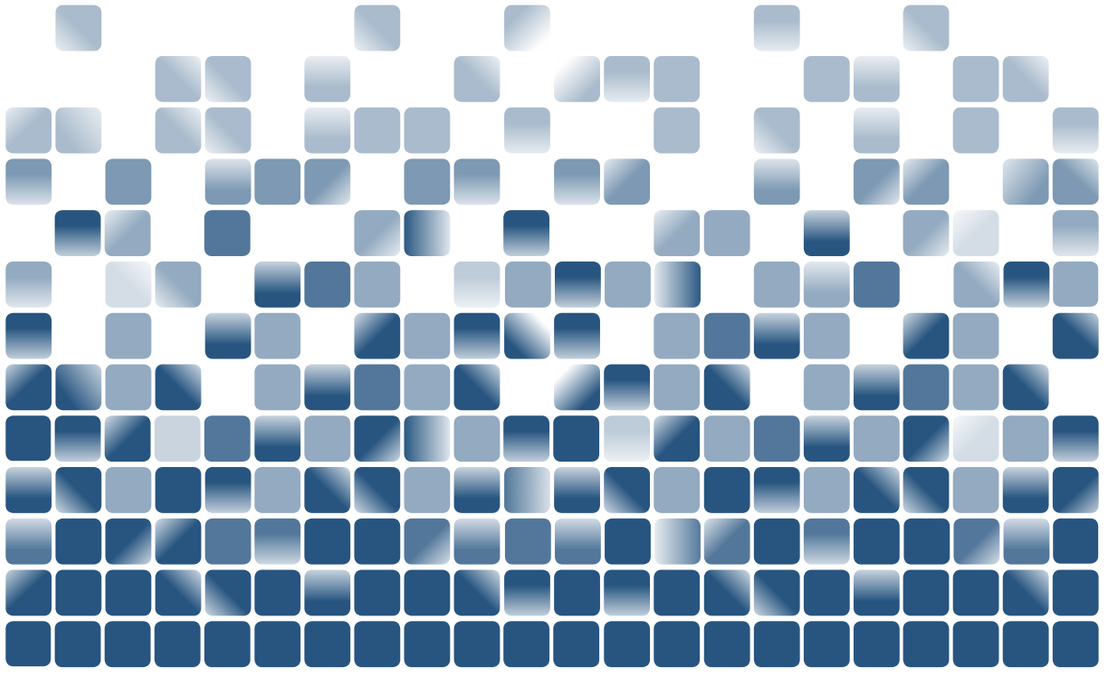
Mrs Imke de Kock
ENGINEERING MANAGEMENT: Technology management; Decision-analysis; Socio-technical transitions. SUSTAINABLE SYSTEMS: System dynamics; Systems analysis; Sustainability science. HEALTH SYSTEMS ENGINEERING & INNOVATION.
imkedk@sun.ac.za

Mr Danie Lötter
OPERATIONS RESEARCH: Multi-objective optimisation, Scheduling, Decision support systems, Combinatorial optimisation.
danielotter@sun.ac.za

Mr Brian van Vuuren
SIMULATION: Agent-based modelling; Decision support systems; Simulation-based optimisation; Simulated system analysis.
brianvv@sun.ac.za

DEPARTEMENT
ELEKTRIESE EN ELEKTRONIESE INGENIEURSWESE

DEPARTMENT OF
ELECTRICAL AND ELECTRONIC ENGINEERING



5 HOOGTEPUNTE

Dr Arnold Rix, eerste bekleër van die Scatec Solar Leerstoel in Fotovoltaïese (PV)-stelsels.

Dr Arnold Rix, first incumbent of the Scatec Solar Chair in Photovoltaic (PV) Systems.

Toekennings

Personeel het in 2015 uitsonderlik presteer. Prof Toit Mouton het een van die hoogste pryse op sy vakgebied ontvang as hoofouteur van 'n artikel wat met een van drie eerste pryse van 'n publikasie van die IEEE bekroon is. Prof David Davidson het 'n gesamentlike IEEE-SAIEE-toekenning as Uitgelese Vrywilliger (Volunteer) gekry vir sy reuse bydrae op sy vakgebied. Prof Petrie Meyer is deur die Universiteit Stellenbosch (US) met die titel Uitgelese Professor vereer. Dr Thinus Booysen en proff Dirk de Villiers en Matthys Botha is vereer as drie uit 25 top navorsers aan die US in die sub-40 jaar-oud kategorie. Dr Booysen is boonop aangewys as een van twee Opkomende Navorsers van die Jaar in die Fakulteit vir 2015. Drie navorsers het Nasionale Navorsingstigtinggraderings ontvang, naamlik prof Maarten Kamper (B3), prof Herman Steyn (B3) en dr Herman Engelbrecht (C3).

Goed gekwalifiseerde akademici

Die Departement Elektriese en Elektroniese (E&E) Ingenieurswese se akademiese korps is uitstekend gekwalifiseer, en 'n groot persentasie beskik oor doktorsgrade. Feitlik die hele Departement se dosente het in 2015 as Professionele Ingenieurs by die Suid-Afrikaanse Ingenieursraad (ECSA) registreer. Die Departement was ook bevoorreg om vier nuwe junior lektore in 2015 in sy midde te verwelkom. Hulle is Nelius Bekker, dr Ryno Beyers, Elmine Botes en dr Jacki Gilmore.

Topstudente

Die Departement se studente presteer ook goed en handhaaf konstant 'n goeie baanrekord. Oor die afgelope ses jaar het drie E&E-studente die jaarlikse Jac van der Merwe Kompetisie vir Innovasie gewen (Wikus Villet 2010; SP le Roux 2012; Andrew de Bruin 2014). In 2015 was Christiaan Viviers, ook van E&E, een van twee medewenners. In 2012, toe die eerste prys ook gedeel is, het nóg 'n medewenner, Henri van Eetveldt, 'n megatroniese student, sy skripsie onder leiding van prof Willie Perold van dié Departement gedoen.

Oplewing in belangstelling

Studentegetalle vir die verskillende Departemente in die Fakulteit Ingenieurswese wissel oor die jare met gewildheid in sekere dissiplines wat fluktueer volgens tendense wat dit beïnvloed. Nadat studentegetalle in die Departement Elektriese en Elektroniese Ingenieurswese 'n paar jaar gelede effe getaan het, is daar tans weer 'n oplewing in die belangstelling in dié rigting. Volgehoue groei in voorgraadse getalle is die afgelope tyd gehandhaaf. In 2015 het die Departement die grootste aantal studente in sy geskiedenis gehad. Die getal voorgraadse studente was 555 waarvan 159 nuweling-eerstejaars is. Die aantal nagraadse studente in 2015 was 193. Die nagraadse programme in die Departement staan sterk, met nege doktorsgrade en 45 meestersgrade wat in 2015 toegeken is. Laasgenoemde is die meeste aantal meestersgrade ooit in die Departement.

Leerstoel in Fotovoltaïese stelsels

Die Leerstoel in Fotovoltaïese (PV)-stelsels, geborg deur die Noorweegse sonkragverskaffer, Scatec Solar, het in Januarie 2015 sy aktiwiteite afgeskop met die aanstelling van die eerste bekleër, dr Arnold Rix. Van sy eerste take was die vestiging van 'n navorsingsgroep waaronder 'n paar meestersgraadstudente tel. Huidige projekte is gebaseer op industriebehoeftes, soos bv. die modellering van sonplase en netwerkintegrasie van sonkragstelsels. 'n Buiteluglaboratorium vir sonkragstelsels is opgerig by die US se proefplaas, Mariendahl, en sal in die toekoms verder uitgebrei word. Van die akademiese aktiwiteite van die Leerstoel sluit in die aanbied van 'n voorgraadse asook 'n nagraadse module. Laasgenoemde, Gevorderde PV-stelsels, is as 'n kortkursus aangebied sodat industrieverteenwoordigers dit ook kon bywoon.

5 HIGHLIGHTS

Awards

In 2015 personnel were recognised for their exceptional achievements. Prof Toit Mouton received one of the highest awards possible in his field as first author of an article that was awarded one of three first prizes in an IEEE publication. Prof David Davidson received a joint IEEE-SAIEE Distinguished Volunteer Award for his major contribution in his field. Prof Petrie Meyer was bestowed the title of Distinguished Professor by Stellenbosch University (SU). Dr Thinus Booysen and Profs Dirk de Villiers and Matthys Botha were honoured as three of 25 top researchers at SU in the sub-40 year age group category. Furthermore, Dr Booysen was joint-winner of the Faculty's Upcoming Researcher Award for 2015. Three researchers received gradings by die National Research Foundation, namely Prof Maarten Kamper (B3), Prof Herman Steyn (B3) and Dr Herman Engelbrecht (C3).

Well-qualified academics

The academic corps of the Department of Electrical and Electronic (E&E) Engineering is highly qualified and a large percentage has doctoral degrees. In 2015 most of the Department's lecturers registered as Professional Engineers with the Engineering Council of South Africa (ECSA). The Department was also privileged to welcome four new junior lecturers in its midst, namely Nelius Bekker, Dr Ryno Beyers, Elmine Botes and Dr Jacki Gilmore.

Top students

The Department's students also perform well and constantly maintain an excellent track record. Over the past six years, three E&E students won the annual Jac van der Merwe Competition for Innovation (Wikus Villet 2010, SP le Roux 2012; Andrew de Bruin 2014). In 2015, another E&E student, Christiaan Viviers, was a joint winner in the Competition. And in 2012 another joint winner, Henri van Eetveldt, a mechatronics student, did his final-year project under the supervision of Prof Willie Perold from this Department.

Renewed interest in field

Student numbers for the different Departments in the Faculty of Engineering vary over the years, because the popularity of the different disciplines fluctuate as a result of the trends that influence it. After a slight decline in student numbers in the Department of Electrical and Electronic Engineering, there is renewed interest in the field and the past few years sustained growth has been evident. In 2015 the Department had its highest number of students in its history. There were 555 undergraduate students of which 159 were new first-year students. In 2015 there were 193 postgraduate students. The Department has a solid and well-established postgraduate programme. In 2015 nine doctoral and 45 master's degrees were awarded, the latter being the highest number ever in this Department.

Chair in Photovoltaic Systems

The Chair in Photovoltaic (PV) Systems, sponsored by the Norwegian solar energy provider, Scatec Solar, kicked off in January 2015 with the appointment of its first incumbent, Dr Arnold Rix. One of his initial tasks was to establish a research group, which includes several master's students carrying out industry-related projects such as modelling of photovoltaic power plants and network integration of solar power systems. An open-air laboratory for solar power systems has been set up at the SU experimental farm, Mariendahl, and will be extended in the future. The academic activities of the Chair included the presentation of an undergraduate module, as well as a postgraduate module in Advanced PV Systems, the latter also being presented as a short course to accommodate members of industry.

Topnavorsers vereer in die kategorie onder veertig is van links dr Thinus Booysen, prof Matthys Botha en prof Dirk de Villiers.

Top reseachers honoured in the category under forty are from the left Dr Thinus Booysen, Prof Matthys Botha and Prof Dirk de Villiers.

FOCUS How much does soiling matter?

Individual monitoring of modules at the Kalkbult research station.

During the past couple of years there has been large investment in renewable energy power plants in South Africa as part of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) initiative of the Department of Energy.

One of the important aspects of this programme is that the selling price of the energy plays a dominant role in the identification of prospective power producers as preferred bidders. This led to a dramatic decline in the bidding prices in successive rounds. This again makes it more and more necessary for the financial models of these projects to be accurate in order to ensure good returns on investment or even to prevent projects from failing.

The technology for solar photovoltaic (PV) energy conversion is quite mature compared to the technology of other renewable energy sources. It is nevertheless still important to understand the impact of a wide variety of factors on the energy yield of PV plants to ensure optimal operation. Some of these factors are those related to environmental conditions.

A research project specifically concerned with the influence of soiling (dust and sand depositing) was initiated at the Department of Electrical and Electronic Engineering to investigate the effect thereof especially in the arid areas of South Africa where most of the current PV power plants can be found. In short, how much does soiling matter? This project is the result of collaboration between South African and Norwegian researchers under the South African Norwegian Collaboration Programme (SANCOOP).

The answer to the above-mentioned question is important on two fronts. For the PV industry it will be useful to improve the accuracy of their financial modelling. But for local communities this is particularly important, since the answer has a direct influence on the employment opportunities for those communities.

The research project started in 2014 and consists of two main efforts. The South African effort concentrates on field measurements over a period of two years. In 2014 the research facility was designed and prepared and subsequently constructed at the Kalkbult power plant near De Aar in the Northern Cape. It consists of 24 stations, each continually monitoring a PV module, i.e. measuring of the characteristics of the panels including the current-voltage curve and the temperature of the panels. This now allows for comparison between a number of different cleaning methods, including some modules left uncleaned and some often cleaned, and anti-soiling coatings.

The Norwegian effort seeks to develop and assess modelling techniques, including optical modelling, to predict the performance of photovoltaic modules under different soiling conditions.

From the combined research effort it is envisaged that the ability will be developed to accurately predict the influence of soiling in Southern Africa.

RESEARCH THEMES

With its four divisions the Department of Electrical and Electronic Engineering focuses in its teaching and research on the four main areas of electrical and electronic engineering.

Robotics

In the Electronic Systems Laboratory (ESL), research, development and projects concentrate mainly on the control of remote sensing platforms. These platforms include satellites (e.g. CubeSats), manned and unmanned aerial vehicles (UAVs) as well as autonomous underwater vehicles (AUVs) and unmanned ground vehicles. As most of the research is done as part of a larger system, students are exposed to the full breadth of the management and technical activities required in complex system development.

Electromagnetics

Current activities focus on the following projects: RF and microwave antennas for communications and radar systems, FEM, FDTD and MoM modelling of antennas and wave propagation in complex electromagnetic environments, development of numerical methods and software for simulation of electromagnetic fields, free-space and near-field measurement techniques, optimising complex antennas and microwave components, the Karoo Array Telescope (KAT) and the Square Kilometre Array (SKA). Other activities include superconducting elements, nanosensors, electromagnetic compatibility, microwave filters and non-linear circuits. An antenna and microwave laboratory, supported by sophisticated instrumentation and powerful computing facilities, provides the infrastructure for research work.

Electrical Energy

This division focuses in research on electrical energy in terms of conversion, distribution, control and management, and renewable energy. Specifically attention is given to multi-level power electronic converters, electrical machine design and drive systems, energy efficiency, and the measurement and management of electrical energy. In renewable energy the focus is on photovoltaic solar energy, wind generator systems, system identification and grid integration. The facilities include world-class laboratories and instrumentation for prototype testing and measurement. The Department has the only high-voltage laboratory in the Western Cape for amongst others advanced insulator tests and research.

Telecommunications and Informatics

This division works in a variety of areas that involve the manipulation of information-bearing signals. This comprises both extracting and embedding information in the signal (digital signal processing), the transmission of such signals over large distances (telecommunication) and through complex networks (communication networks), and the automatic learning and recognition of the signal content (machine learning) with particular focus on speech and image signals, as well as specialised sensor signals.

Chairperson
Prof Maarten Kamper
ELECTRICAL MACHINE SYSTEMS: Electrical machine design; Electrical drives and control; Renewable energy generator systems.
kamper@sun.ac.za

Mr Arno Barnard
COMPUTER SYSTEMS: Space vehicle electronics; FPGA and DSP design; Microcontrollers; Radiation influence and mitigation techniques.
abarnard@sun.ac.za

Mr Nelius Bekker
POWER SYSTEM MODELLING: Demand-side management; Measurement and verification; Renewable energy systems; Parameter estimation.
neliusb@sun.ac.za

Dr Johan Beukes
POWER ELECTRONICS AND APPLICATIONS: Utility applications of power electronic converters.
jbeukes@sun.ac.za

Dr Ryno Beyers
MICROWAVE CIRCUITS: Network synthesis; Microwave passive devices.
rdb@sun.ac.za

Dr Thinus Booysen
VEHICULAR AND COMPUTER SYSTEMS: Intelligent transportation systems; Vehicular ad-hoc networks; Infotainment; Machine-to-machine communication.
mjbooysen@sun.ac.za

Ms Elmine Botes
MICROWAVE CIRCUITS: Tunable microwave filters.
ebotes@sun.ac.za

Prof Matthys Botha
COMPUTATIONAL ELECTROMAGNETICS: Numerical techniques for EM analysis.
mmbotha@sun.ac.za

Prof David Davidson
COMPUTATIONAL ELECTROMAGNETICS: South African Square Kilometre Array Research Chair in Engineering Electromagnetics; Fellow, IEEE.
davidson@sun.ac.za

Prof Johann de Swardt
MICROWAVE ELECTRONICS: Non-linear microwave circuits; Microwave active components.
deswardt@sun.ac.za

Prof Dirk de Villiers
ANTENNAS AND MICROWAVES: Design and modelling of antennas and microwave passive devices.
ddv@sun.ac.za

Prof Johan du Preez
SPEECH PROCESSING AND PATTERN RECOGNITION: Speaker, speech and language recognition.
dupreez@sun.ac.za

Dr Herman Engelbrecht
NETWORKS AND DISTRIBUTED SYSTEMS: Networking and networked applications; Peer-to-peer applications; Cloud computing; Massive multiuser virtual environments; Machine learning.
hebrecht@sun.ac.za

Mr Japie Engelbrecht
AEROSPACE CONTROL SYSTEMS: Manned/unmanned aircraft flight control and navigation; NAC Chair of Learning and Airbus collaboration contact point; Satellite actuators and control.
jengelbr@sun.ac.za

Prof Coenrad Fourie
ELECTRONICS: Superconductor circuits; SQUID magnetometry; Geomagnetism and space weather monitoring; VLSI inductance extraction.
coenrad@sun.ac.za

Dr Jacki Gilmore
ANTENNAS: South African Square Kilometre Array; Antenna element and feed design; Electromagnetic modelling.
jackivdm@sun.ac.za

Dr Nkosinathi Gule
ELECTRICAL MACHINES AND DRIVES: Multiphase induction machine drives and control; Renewable energy and power systems.
nathie@sun.ac.za

Dr Willem Jordaan
SATELLITE CONTROL SYSTEMS: Satellite systems; Satellite orbit and attitude control; Process control; Adaptive control; Embedded systems.
wjordaan@sun.ac.za

Prof Petrie Meyer
MICROWAVE CIRCUITS: Network synthesis; Microwave filters; Low-noise amplifiers; Numerical modelling.
pmeyer@sun.ac.za

Prof Toit Mouton
POWER ELECTRONICS: Converter technology; Multilevel converters; AC to DC converters; Control of power electronic converters.
dtmouton@sun.ac.za

Mr Fredrick Mwaniki
POWER ELECTRONICS; ELECTRICAL DRIVES: Renewable energy; Power systems.
fmmwaniki@sun.ac.za

Prof Thomas Niesler
SPEECH PROCESSING AND PATTERN RECOGNITION: Speaker, speech and language recognition.
trn@sun.ac.za

Prof Willie Perold
ELECTRONICS: Superconducting Josephson circuits; SQUID sensors; Nanotechnology sensing devices.
wjperold@sun.ac.za

Dr Arnold Rix
PHOTOVOLTAIC SYSTEMS: Solar PV technology; Power electronics; Energy efficiency; Rooftop and utility scale solar PV; Energy modelling; Solar resource assessment; Performance monitoring; Network integration.
rix@sun.ac.za

CONTACTS

Mr Willem Smit
DIGITAL HARDWARE: FPGA and DSP design; Camera systems and security applications.
wsmit@sun.ac.za

Prof Herman Steyn
AEROSPACE & INDUSTRIAL CONTROL SYSTEMS: Satellite systems; Satellite orbit and attitude control; Process control; Adaptive control.
whsteyn@sun.ac.za

Dr Johann Strauss
ELECTRICAL ENERGY SYSTEMS: Efficient energy conversion; Linear generators.
jstrauss@sun.ac.za

Dr Corné van Daalen
AUTONOMOUS SYSTEMS: Autonomous navigation, planning, conflict detection and resolution.
cvdaalen@sun.ac.za

Dr Carlo van Niekerk
ANTENNAS AND PROPAGATION: Electrically small antennas; Antenna circuit modeling; Radar target design; Embedded antenna design.
cvanniekerk@sun.ac.za

Prof Johan Vermeulen
POWER SYSTEMS, HIGH VOLTAGE & END-USER TECHNOLOGIES: Power system dynamics and modelling; HV measurements and insulation; Demand-side management; Energy management; Energy efficiency.
vermeuln@sun.ac.za

Prof Rong-Jie Wang
ELECTRICAL MACHINE SYSTEMS: Special electrical machines; Finite element modelling; Renewable energy systems; Thermal analysis in power devices.
rwang@sun.ac.za

Dr Gideon Wiid
HIGH FREQUENCY SYSTEMS: South African Square Kilometre Array; Electromagnetic compatibility; RFI characterisation; Metrology.
wiidg@sun.ac.za

DEPARTEMENT
MEGANIESE EN MEGATRONIESE INGENIEURSWESE

DEPARTMENT OF
MECHANICAL AND MECHATRONIC ENGINEERING

5 HOOGTEPUNTE

Die Helio100-projek is tydens ’n tegniese toer vertoon ná afloop van die SolarPACES-konferensie.

The Helio100 Project was showcased during a technical tour after the conclusion of the SolarPACES conference.

Groot ontwikkelingsprojek

Die Departement het ’n toekenning van R10 miljoen van die Europese Unie se Horizon 2020-program gekry vir ’n ontwikkelingsprojek wat fokus op die minimering van waterverbruik by sonkragstasies. Die R90 miljoen-projek, *MinWaterCSP*, word deur Kelvion Holdings, in Duitsland, gekoördineer en bestaan uit 12 vennote in ’n internasionale konsortium van ses verskillende Europese en Nie-Europese lande. ’n Reuse toetsfasiliteit sal by die Fakulteit Ingenieurswese, Universiteit Stellenbosch (US), opgerig word. Dit sal bestaan uit ’n verkoelingstelsel (ontwerp deur prof Hanno Reuter) en ’n waaier (ontwerp deur proff Johan van der Spuy, Christiaan Meyer en dr Danie Els). Prof Maarten Kamper (Departement Elektriese en Elektroniese Ingenieurswese) is verantwoordelik vir die ontwerp van die elektriese aandrywing van die waaier. Drie oudstudente, drs Francois Louw en Albert Zapke (beide van Kelvion), en dr Tom Fluri (Fraunhofer Stigting), speel ook ’n beduidende rol in die projek.

Navorsing oor stusakke

Wanneer goedere in multimodale vraghouers vervoer word, word stumateriaal, soos opblaasbare sakke, gebruik om goedere in plek te hou en te beskerm. ’n Navorsingsprojek met dr Martin Venter aan die hoof behels die numeriese prototipering van opblaasbare stusakke. Die doel van die projek is eerstens om inligting in te insamel om die hulpmiddels beter te verstaan, die mees waarskynlike areas van hoë spanningsdruk te bepaal en om ontwerpsbesluite te neem wat falingsrisiko sal beperk. Tweedens is daar gepoog om ’n numeriese simulasiemodel te ontwikkel wat kan wegdoen met tydrowende en duur fisiese toetsing van stusakke. ’n Numeriese simulasiemetode is nou ontwikkel en ’n model daar gestel waarmee goeie korrelasie verkry kan word tussen fisiese toetse en simulasie. Die moontlikheid om die model op verskillende tegnologieë toe te pas, soos bv. opblaasbare onbemande voertuie, word ook ondersoek.

3D-druk

Die nuut-gestigte Materiaalingenieurswesegroep het ’n verskeidenheid navorsingsbelangstellings wat ’n fokus op die meganiese eienskappe van 3D-gedrukte titaanallooie insluit. Die stigter van die groep, dr Thorsten Becker, het KU Leuven in België besoek om saam te werk met eweknieë daar wat oor ’n goed-gevestigde navorsingsprogram op die gebied beskik. Die doel van sy besoek was om te bepaal tot watter mate interne spanningsdruk as gevolg van die inherente drukproses vorm en hoe om onderdeelintegriteit te verseker. Die samewerking met KU Leuven is een van ’n paar navorsingsverbintenisse wat deur dr Becker en sy groep gevestig is. Die groep werk nou saam met kollegas in die US Departement Bedryfsingenieurswese op die toepassing van 3D-druk in die biomediese- en lugvaartkundige velde sowel as met die Departement Materiale by die Universiteit van Oxford, Verenigde Koninkryk.

Helio100 voltooi

Die Sontermiese Energienavorsingsgroep (STERG) het in 2015 die Helio100-projek voltooi. Dié loodsprojek is deur die Tegnologie-innovasie-agentskap befonds en behels die ontwikkeling van ’n volbloed-Suid-Afrikaanse heliostaatstelsel wat gebruik maak van ’n unieke ontwerp bestaande uit kleiner, slimmer, modulêre heliostate wat meer kostedoeltreffend is. ’n Toetssentrum is op ’n US-proefplaas, Mariendahl, opgerig en in September bekendgestel. STERG is die eerste universiteitsnavorsingsgroep in die land wat op sontermiese krag fokus. Die projek is tydens ’n tegniese toer vertoon na afloop van die jaarlikse SolarPACES-konferensie in Kaapstad in Oktober wat deur 551 plaaslike en internasionale afgevaardigdes van navorsingsinstansies, staatsliggame, finansiële instellings en kommersiële entiteite van 38 lande bygewoon is. STERG is goed by SolarPACES verteenwoordig.

Hommeltuie vir instandhouding

Gekonsentreerde sonkragstasies vereis voortdurende monitering en instandhouding om optimaal te funksioneer. Instandhouding behels die skoonmaak, herinstelling en kalibrering van die spieëls. As gevolg van die blote volume van spieëls in ’n tipiese gekonsentreerde sonkragstasie mag die instandhoudingsprosedures baie lank en duur raak indien dit met die hand gedoen moet word. Nagraadse studente by STERG en hul studieleier, dr Willie Smit, is besig om die moontlikheid te ondersoek om instandhouding gedeeltelik te outomatiseer deur gebruik te maak van hommeltuie. Hul projek oor die opsporing en vermyding van hindernisse ondersoek die moontlikheid om ’n hommeltuig met sensore soos kameras of LiDAR in te span om heliostate mee te kalibreer. Indien hulle sukses behaal, kan een van die voordele wees dat kalibrering selfs in die nag gedoen kan word en nie slegs deur die dag as die son skyn nie.

5 HIGHLIGHTS

Large development project

The Department received R10 million from the European Union’s Horizon 2020 programme for a development project focusing on minimising water consumption in CSP plants. The R90 million project, *MinWaterCSP*, is coordinated by Kelvion Holdings in Germany, and consists of 12 partners in an international consortium of six different EU-member and Non-EU countries. A large testing facility will be erected at the Faculty of Engineering, Stellenbosch University (SU). It will comprise a cooling system (designed by Prof Hanno Reuter) and a fan (designed by Profs Johan van der Spuy, Christiaan Meyer and Dr Danie Els). Prof Maarten Kamper (Department of Electrical and Electronic Engineering) is responsible for the design of the fan’s electrical drive system. Three alumni, Drs Francois Louw and Albert Zapke (both from Kelvion), and Dr Tom Fluri, (Fraunhofer Institute) also play a significant role in the project.

Research on dunnage bags

When transporting goods in multi-modal containers, dunnage material, such as inflatable bags, is used to restrain and protect goods. A research project headed by Dr Martin Venter involves the numerical prototyping of inflatable dunnage bags. The project firstly aims to generate information to promote an understanding of the devices, determine the likely areas of high stress and make design decisions to minimise the risk of failure. Secondly, it aims to develop a numerical simulation method that could do away with the time-consuming and expensive physical testing of dunnage bags. A numerical simulation method has now been developed and a model put into place where a good correlation can be obtained between the physical test and the simulation. The possibility of applying the model to different technologies, such as inflatable unmanned vehicles, is also being investigated.

3D printing

The newly formed Materials Engineering group has a variety of research interests including a focus on the mechanical properties of 3D printed titanium alloys. The founder of the group, Dr Thorsten Becker, visited KU Leuven in Belgium to collaborate with peers that have a well-established research programme in this field. The aim of his visit was to determine to what extent internal stresses form due to the inherent 3D printing process and how to ensure resultant part integrity. The collaboration with KU Leuven is one of a few research connections established by Dr Becker and his group. The group works closely with colleagues in the SU Department of Industrial Engineering on the application of 3D printing in the biomedical and aeronautical fields as well as with the Department of Materials at Oxford University, United Kingdom.

Helio100 completed

The Solar Thermal Energy Research Group (STERG) completed the Helio100 Project in 2015. This pilot project, funded by the Technology Innovation Agency, involves the development of a purebred South African heliostat system that uses a unique design comprising smaller, smarter, modular heliostats to overcome cost challenges. A pilot facility was constructed at Mariendahl, an SU experimental farm, and was officially opened in September. STERG is the first university research group in the country to focus on solar thermal energy research. This project was showcased during a technical tour after the conclusion of the annual SolarPACES conference in Cape Town in October attended by 551 local and international delegates from research institutes, governmental bodies, financial institutions and commercial entities from 38 countries. STERG was well represented at SolarPACES.

Multicopters for maintenance

Concentrating Solar Power (CSP) plants require constant monitoring and maintenance to operate at optimal levels. This maintenance involves cleaning, re-aligning and calibrating the mirrors. Due to the sheer volume of mirrors present in a typical CSP plant these simple maintenance procedures may become lengthy and very costly if done manually. Postgraduate students at STERG and their supervisor, Dr Willie Smit, are investigating the possibility of partial automatisation by using multicopters for maintenance of CSP plants. Their project, titled *Obstacle detection and avoidance*, looks into equipping the multicopters with sensors such as cameras or Light Detection and Ranging (LiDAR) in order to detect obstacles. If successful, one of the benefits could be that heliostats can be calibrated at night and not only during the day when the sun shines.

’n Voorbeeld van ’n hommeltuig.

An example of a muticopter.

FOCUS Biomedical Engineering

Three examples of biomedical engineering research at Stellenbosch University are from the left diagnostic technology, telemedicine and sports technology.

Biomedical Engineering is a multidisciplinary field which involves any applications of Physics, Mathematics, Sciences and Engineering at the intersections of Biology, Medicine and Health Sciences. It aims to solve or at least improve health-related problems in both animals and humans.

The Biomedical Engineering Research Group (BERG) was established in the Department of Mechanical and Mechatronic Engineering in 2005 as a result of growing interest from industry, Stellenbosch University (SU) staff and students in the field of Biomedical Engineering (BME). Under the leadership of the late Prof Cornie Scheffer BERG developed a superb track record of national and international collaborations.

The formation of the Institute for Biomedical Engineering (IBE) in 2015 was motivated by the critical mass achieved in BME research at SU. The IBE's mandate is to strengthen existing and build additional research capacity across different faculties. This will integrate the efforts of researchers within the Faculties of Engineering, Science, Medicine and Health Sciences, AgriSciences and other institutes and centres at Stellenbosch. Considerable interdepartmental collaboration and resource use already exist, along with internal and external financial support. Focus areas include, but are not limited to:

- Micro and Nanotechnology
- Computational Biomechanical Modelling
- Tissue Engineering, Epidemiology and Biostatistics
- Metabolic Modelling
- Neurosciences and Electrophysiology
- Molecular and Computational Biotechnology
- Intellectual property development and Commercialisation

The choice of technologies intended for development by the IBE is also guided by proactive selection based on recommendations made by the World Health Organisation regarding Sub-Saharan African requirements and by needs identified locally, i.e. in Stellenbosch. For example, alleviating the burden of chronic and infectious diseases through early diagnosis, reducing dependence on the importation of medical devices, water purity and sanitation provision are all strong motivators for products to be developed. A principle focus of the IBE is on the production of publishable research outputs and postgraduate degrees. This aims to build human capacity through training engineers, researchers and technicians in BME.

Prof Martin Nieuwoudt has been the driver behind the establishment of the IBE, while his colleague, Prof Pieter Fourie, is the current Head of BERG. The IBE and BERG jointly organised their 2nd BME conference during March of 2016. This highly successful conference was attended by more than 100 colleagues and students from both local and international institutions.

At present the core staff of the IBE and BERG are in a process of defining key indicators and long term strategic goals by which the momentum of BME will be maintained both within SU and in Southern Africa as a whole.

Structures and Optimisation

Develop advanced optimisation algorithms, including applications in structures; Examine natural frequencies; Strength and durability of mechanical structures are determined using analytical and numerical methods (FEM), laboratory tests and field measurements.

Materials Engineering

Powder metal processing and products, focusing on titanium and its alloys; Nanoporous and structured PGM (platinum-group metals) alloys; Continuous fibre-reinforced thermoset composites for aviation components and structures; Composite material failure phenomena; Material property extraction using digital image and volume correlation; Component life estimate of power plant steels, focusing on fracture and creep deformation; Qualification of additive manufactured parts for biomedical and aerospace components.

Sound, Vibration and Dynamics

Human reaction to hand-arm and whole-body vibration; Dynamic seat test characterisation; Evaluating sound quality; Modelling and simulation of dynamic system behaviour in applications such as flight mechanics, trains, satellites and riding comfort of vehicles.

Mechanical and Mechatronic Design, Automation

Mechatronic system design, including machine vision and automated manufacturing; Reverse engineering; Micro-metrology.

Granular Flow Modelling

Numerical models (discrete element and continuum methods) of the motion of granular materials, applied to mining and earthmoving equipment, particle dampers, conveyors, etc.

Biomedical Mechatronics

Minimally invasive devices to collect healthcare information; Customised solutions for the treatment of specific diseases; Biomedical mechatronic devices for telemedicine; Medical sensors for *in vivo* testing of human knee biomechanical properties.

Energy and Environment

In collaboration with the Centre for Renewable and Sustainable Energy Studies; Renewable energy provision, particularly concentrating solar-thermal power and energy storage systems; Testing fans, heat exchangers and cooling tower fills to international test standards; World-leading research in air-cooled heat exchangers and cooling towers; Modelling of industrial cooling systems; Thermodynamic cycle development.

Turbomachinery

Development of special fans, compressors and turbines, e.g. for ocean current, wind, and solar energy exploitation, and for air-cooled systems.

Marine Engineering

Energy efficient ship propulsion and hull design; Towing tank, cavitation tunnel and recirculation tank testing.

Two-phase Flow

Two-phase flow and heat transfer; Heat pipes and other two-phase flow and heat transfer devices; Sustainable thermal and energy management; Temperature control using natural circulation loops.

Computational Fluid Dynamics

Modelling thermo-fluid phenomena e.g. two-phase atmospheric particle flow; Internal combustion and other engines; The atmospheric environment around cooling towers and solar chimney power stations; Fans and their environment; Flow around ship components; Biomedical applications.

Engine Testing of Biofuels and Blends

Engine tests of biofuels and blends in compression-ignition and spark-ignition engines on dynamometer test stands; Determination of engine performance, exhaust gas emissions, combustion quality and heat release.

Nuclear Engineering

Passive and natural convection cooling of reactor systems; Reactor waste heat recovery and utilisation systems.

Metal Casting

Modelling and simulation of metal casting processes with emphasis on solidification and microsegregation; Modelling of solute diffusion during heat treatment; Directional solidification of superalloys (gas turbine blades); Experimental analysis of solidification and heat treatment; Microstructural analysis.

Ontwerp en Megatronika | Design and Mechatronics

Chairperson
Prof Kristiaan Schreve
MECHANICAL AND MECHATRONIC DESIGN: Micrometrology; Machine vision; Reverse engineering.
kschreve@sun.ac.za

Prof Anton Basson
MECHANICAL AND MECHATRONIC DESIGN: Design for manufacturing; Distributed control systems; Automation of manufacturing.
ahb@sun.ac.za

Prof Pieter Fourie
BIOMEDICAL ENGINEERING: The conceptualisation, research and development of innovative technologies to meet the needs within the South African society.
prfourie@sun.ac.za

Prof Nawaz Mahomed
COMPUTATIONAL MECHANICS: High viscous flows; Metal casting; Heat treatment; Microsegregation. RENEWABLE ENERGY: Renewable energy systems.
nawaz@sun.ac.za

Dr Corné Coetzee
MODELLING OF GRANULAR FLOWS: Meshless finite elements and discrete element method.
ccoetzee@sun.ac.za

Dr Danie Els
MECHANICAL DESIGN: Systems engineering and design optimisation; Modelling of granular flows and particle dampers; Infantry weapon systems and fuze design.
dnjels@sun.ac.za

Dr Cobus Müller
MECHANICAL DESIGN/MECHATRONICS/ BIOMEDICAL ENGINEERING: Biomechanics; Simulation and analysis of biomechanical systems; Measurement of physiological parameters.
cobusmul@sun.ac.za

Dr Willie Smit
MECHATRONICS: Unmanned aerial vehicles; Image processing; Pattern recognition.
wjsmit@sun.ac.za

Dr Dawie van den Heever
BIOMEDICAL ENGINEERING: Sport biomechanics; Brain computer interfacing; Brain imaging techniques; Biological signal analysis.
dawie@sun.ac.za

Mr Johan van der Merwe
BIOMEDICAL ENGINEERING: Patient-specific orthopaedic implant and instrument design; Statistical shape modelling.
jovdmerwe@sun.ac.za

Mrs Liora Ginsberg
MECHANICAL DESIGN: Biomechanics; Biofluids.
ginsberg@sun.ac.za

Mr Piero Trinchero
MECHANICAL DESIGN: Engineering drawing, CAD and Machine design.
ptrinchero@sun.ac.za

Dr Michael Owen
HEAT TRANSFER AND FLUID DYNAMICS: Air-cooled steam condensers; Computational fluid dynamics.
mikeowen@sun.ac.za

Mr Jacques Muiyser
AEROELASTICITY AND STRUCTURAL DYNAMICS: Measurement and analysis of air-cooled heat exchanger fan system dynamics and vibration.
jmuiyser@sun.ac.za

Mr Karel Kruger
MECHANICAL AND MECHATRONIC DESIGN: Design and control of modern manufacturing and assembly systems; Industrial robot programming; Machine vision.
kkruger@sun.ac.za

Mr Gareth Erfort
Open source CFD; Robotics; Wind energy.
erfort@sun.ac.za

Termovloei | Thermo-fluids

Prof Thomas Harms
ENERGY SYSTEMS: Computational fluid dynamics; Renewable energy.
tmh@sun.ac.za

Prof Theo von Backström
TURBOMACHINERY: Fan design; Solar thermal energy systems; Fluid mechanics; Ocean energy.
twvb@sun.ac.za

Prof Frank Dinter
SOLAR THERMAL ENERGY SYSTEMS: Eskom Chair in Concentrating Solar Power (CSP)
frankdinter@sun.ac.za

Prof Christiaan Meyer
MULTIPHASE FLOWS: Mineral processing; Particulate dispersion and suspension; Non-Newtonian behaviour of multiphase fluids; Combustion.
cjmeyer@sun.ac.za

Prof Willem Nel
ENERGY MODELLING: Simulation and modelling of integrated energy systems; STRUCTURAL INTEGRITY ASSESSMENT: In-service degradation of mechanical components.
willemnel@sun.ac.za

Prof Johan van der Spuy
FLUID MECHANICS AND TURBOMACHINERY: Axial flow fan development; Application of axial flow fans in air-cooled condensers; Micro gas turbine compressor development. Application of micro gas turbines.
sjvdspuy@sun.ac.za

Dr Jaap Hoffmann
THERMODYNAMICS, FLUID DYNAMICS AND HEAT TRANSFER: Computational fluid dynamics; Dispersed two-phase flow.
hoffmaj@sun.ac.za

Mr Robert Dobson
HEAT TRANSFER: Two-phase flow and heat transfer; Heat pipes, heat transfer devices; Sustainable thermal and energy management and temperature control.
rtd@sun.ac.za

Mr Paul Gauché
SOLAR THERMAL ENERGY: Concentrating Solar Power (CSP) systems modelling; Technology readiness; Optics; Thermodynamics; Heat transfer and fluid mechanics.
paulgauche@sun.ac.za

Mr Richard Haines
INTERNAL COMBUSTION ENGINES: Compression-ignition and spark-ignition engine performance evaluations of biofuels and blends.
rhaines@sun.ac.za

Mr Carl Tshamala
THERMODYNAMICS AND HEAT TRANSFER: Power generation; Cooling systems performance evaluation and optimisation for industrial applications.
mctshamala@sun.ac.za

Mrs Dimitra Westdyk
THERMODYNAMICS: Air-conditioning; Refrigeration; Thermodynamics and heat transfer.
dw1@sun.ac.za

CONTACTS

Meganika | Mechanics

Prof Gerhard Venter
COMPUTATIONAL MECHANICS: Structural analysis and optimisation; Multidisciplinary optimisation.
gventer@sun.ac.za

Prof Albert Groenwold:
COMPUTATIONAL MECHANICS: Structural analysis and optimisation; Finite element techniques.
albertg@sun.ac.za

Prof Wikus van Niekerk
RENEWABLE AND SUSTAINABLE ENERGY STUDIES; Solar, ocean and wind energy, for both utility and small-scale electricity generation.
wikus@sun.ac.za

Dr Deborah Blaine
MATERIALS ENGINEERING: Powder and particulate materials; Characterisation of material properties; Material development.
dcblaine@sun.ac.za

Dr Annie Bekker
SOUND AND VIBRATION: Measurement; Human response; Order analysis and signature testing; Modal testing; Automotive NVH; Sound quality; Viscoelasticity.
annieb@sun.ac.za

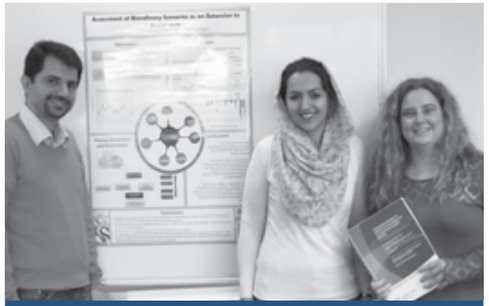
Dr Martin Venter
COMPUTATIONAL MECHANICS: Structural analysis; Inflatable structures; Materials characterisation; Textile composites.
mpventer@sun.ac.za

Dr Thorsten Becker
MATERIALS ENGINEERING: Fracture mechanics; Damage mechanics; Characterisation of material properties; Digital image and volume correlation; Selective laser melting.
tbecker@sun.ac.za

DEPARTEMENT
PROSESINGENIEURSWESE

DEPARTMENT OF
PROCESS ENGINEERING

5 HOOGTEPUNTE



Die span wat die Green Fundprojek uitgevoer het.

The team responsible for the Green Fund project.

Waterfilters

Prof Lingam Pillay se navorsingsgroep het R6,1 miljoen van die Departement Wetenskap en Tegnologie/Waternavorsingskommissie ontvang om 1 000 huishoudelike waterfilters te ontwikkel en te demonstreer in landelike dorpies in Limpopo en die Oos-Kaap. Die filters is gebaseer op die geweefde mikrofiltrasietegnologie wat in Suid-Afrika ontwikkel is uit samewerking tussen die Universiteit van Stellenbosch (US), Durban Universiteit van Tegnologie, Savanna State University in die VSA en die Asian Institute of Technology in Thailand met behulp van befondsing hoofsaaklik van die Waternavorsingskommissie en Umgeni Water. 'n Innovusmaatskappy, *VulAmanz*, is op die been gebring om die projek te bestuur en kommersialisering van die tegnologie te ondersoek. Twee nuwe tegnologieë vors ook die moontlikheid na van kleinskaalse, gedesentraliseerde behandeling van afvalwater en verskaffing van drinkwater aan klein en groot dorpe.

Beter benutting van plantmateriaal

Die Green Fundprojek van die Bioprosesingenieurswesegroep, onder leiding van prof Johann Görgens, is in 2015 voltooi. Hierdie projek het oor 18-maande gestrek en is deur die Ontwikkelingsbank van Suid-Afrika befonds. Dit het die ontwikkeling van nuwe ekonomiese geleenthede in die suikerindustrie ondersoek deur plantmateriaal beter te benut in die vervaardiging van waardevolle chemikalieë, brandstof en elektrisiteit. Die voltooiing van die projek is in November 2015 afgesluit met 'n werksessie in Stellenbosch met belanghebbers in die suikerbedryf waartydens terugvoer verskaf en resultate bespreek is. Alhoewel dit 'n groot uitdaging was om data te verkry en daar gevind is dat winsgewendheid beperk is, is 'n positiewe uitkoms van die werksessie dat die projek kan voortgaan danksy nuwe befondsing van die Suid-Afrikaanse Suikermeulenaarsvereniging.

Skakeling met Manchester

Dr Annie Chimphango het die Universiteit van Manchester in die Verenigde Koninkryk besoek as gas van prof Patricia Thornley, direkteur van die SUPERGEN Bioenergiegroep. Dr Chimphango het 'n aanbieding oor haar bioenergiegroep se navorsingsaktiwiteite aan die SUPERGEN-navorsingsgroep gedoen om moontlike navorsingsgebiede te identifiseer vir toekomstige wedersydse skakeling. Gedurende haar besoek het sy 'n geleentheid (*Bioenergy: An engine for economic growth in the global south?*) bygewoon en ook 'n aanbieding gedoen. Sy was medefasiliteerder by 'n werksessie oor grondbenuttingsaspekte verwant aan verskillende bioenergiestelsels en die beste integrasie van bioenergie om voedsel- en energiesekuriteit te verskaf. Die skakeling met die Universiteit van Manchester het reeds uitgeloop op verskeie gesamentlike navorsingsvoorstelle vir samewerking op navorsingsgebied.

Verbeterde landbouproduktiwiteit

Dr Annie Chimphango het ook deelgeneem aan 'n maandlange program van die Australia Awards Fellowships (AAF) wat poog om landbouproduktiwiteit te verbeter deur die impak van navorsing in Afrika te verhoog. Dit is deur die Universiteit van Sydney aangebied. Die program het werksessies ingesluit wat gelei is deur navorsers, akademici en bedryfspersone wat wêreldleiers op hul gebied is. Sy het ook agribesighede en navorsingsinstansies besoek waar koördinering van belanghebbers in die landbouwaardeketting duidelik waargeneem kon word. Die program se benadering van leer deur middel van ervaring het 'n goeie koppelvlak gebied tussen die uitvoer van navorsing en die positiewe impak op die gemeenskap. Deur dit toe te pas, kon haar groep se navorsing op só 'n wyse strategies binne die waardeketting oriënteer word dat dit aspekte van voedselsekuriteit, energiesekuriteit en sosio-ekonomiese ontwikkeling kon aanspreek.

Herverbruik van water in kollig

Prof André Burger het een van vier hoofredes gelewer by 'n konferensie van die Waterinstituut van Suidelike-Afrika oor waterherverbruik in Suidelike-Afrika (*Water reuse in Southern Africa: Current status and future imperatives)*. Sy hoofrede, getitel *Membrane desalination: Concepts and perspectives related to energy consumption*, het gehandel oor die minimum energie wat vir ontsouting benodig word asook ontwerpmetodes waarmee energieverbruik in membraanstelsels minimeer kan word. Die ander drie hoofredes is deur internasionale sprekers van die VSA, Duitsland en Hongkong gelewer. Hierdie konferensie was 'n ideale platform om Suid-Afrikaanse waterverskaffingsingenieurs bloot te stel aan moderne konsepte en denke ten opsigte van die hergebruik van water onder andere ook waar membrane ter sprake is.

5 HIGHLIGHTS

Water filters

Prof Lingam Pillay's research group received R6,1 million from the Department of Science and Technology/Water Research Commission to develop and demonstrate 1 000 point-of-use household water filters in rural villages in Limpopo and the Eastern Cape. The filters are based on the woven fabric microfiltration technology developed in South Africa from a collaboration between Stellenbosch University (SU), Durban University of Technology, Savannah State University in the USA, and the Asian Institute of Technology in Thailand, mainly sponsored by die Water Research Commission and Umgeni Water. An Innovus company, *VulAmanz*, has been set up to manage the project and pursue commercialisation of the technology. Two new spin-off technologies are also being researched regarding small-scale decentralised wastewater treatment and potable water provision to small towns and large villages.

Improved use of biomass

The Green Fund project of the Bioprocess Engineering group, headed by Prof Johann Görgens, was completed in 2015. This 18-month project, funded by the Development Bank of South Africa, investigated the development of new economic opportunities in the sugar industry through more efficient use of biomass for the production of chemicals, fuels and electricity. The completion of the project culminated in a workshop held with stakeholders in the sugar industry in November 2015 in Stellenbosch where feedback was provided and results discussed. Although obtaining data was challenging and profitability was found to be limited, a positive outcome of the workshop is the continuation of the project as a result of more funding by the South African Sugar Millers' Association.

Cooperation with Manchester

Dr Annie Chimphango visited the University of Manchester in the United Kingdom, hosted by Prof Patricia Thornley, SUPERGEN Bioenergy hub Director. Dr Chimphango presented to the SUPERGEN research group on bioenergy research activities at Stellenbosch University, in order to identify areas for fostering research links with the hub. During her stay she attended and presented at a bioenergy event (*Bioenergy: An engine for economic growth in the global south?)*. She co-facilitated a workshop on land-use issues associated with different bioenergy systems and how bioenergy can best be integrated to provide food and energy security. The link with the University of Manchester has resulted in several joint research proposals for collaborative research.

Improved agricultural productivity

Dr Annie Chimphango also participated in a month-long Australia Awards Fellowships (AAF) programme on *Improving agricultural productivity through increasing the impact of agricultural research in Africa* hosted by University of Sydney. The programme involved workshops led by world-leading researchers, academics and industry people. In addition, she visited several agribusinesses and research institutions, which showed coordination of stakeholders in the agricultural value chain. The experiential learning approach used in the programme interfaced between conducting research and positively impacting society, which was quite effective in enabling strategic orientation of own research within the agricultural value chain in a manner that addresses issues of food security, energy security and socioeconomic development.

Reuse of water in spotlight

Prof André Burger was one of four keynote speakers at a conference presented by the Water Institute of Southern Africa, *Water reuse in Southern Africa: Current status and future imperatives*. In his presentation, titled *Membrane desalination: Concepts and perspectives related to energy consumption*, he addressed the minimum energy requirements for desalination as well as the design methods for minimising energy use in membrane systems. Three international speakers from the USA, Germany and Hong Kong delivered the other keynote addresses. This conference provided an excellent platform for South African water engineers to be exposed to modern concepts and thinking regarding reuse of water including instances where membranes are utilised.

Die huishoudelike waterfilter.

The household water filter.

FOCUS Metal recovery from electronic waste

Pierre Albertyn in the hydrometallurgy laboratory busy with experiments to evaluate thiosulphate leaching of gold from waste printed circuit boards.

Consumer electronic devices such as cell phones, televisions, computers and tablets have become an integral part of our daily life; as a result, these industries are highly competitive and companies constantly aim to introduce improved products to the market. This continuously increasing rate of technological development has, however, also led to a decrease in the life-span of electronic devices and an increase in the rate at which these devices are discarded.

Electronic waste is classified as the fastest growing component of municipal solid waste in South Africa. According to a report by the Institute for the Advanced Study of Sustainability at the United Nations University, 346 000 tonnes of electronic waste was generated in South Africa in 2014. In South Africa, a large portion of electronic waste currently finds its way to landfill sites while very limited infrastructure exists for treatment of waste that is recycled.

Effective management of electronic waste is important to reduce the potential hazardous impact of metals such as cadmium, lead and mercury on the environment. The presence of valuable metals such as copper, silver, gold and palladium also provides an economic incentive for electronic waste recycling.

The research conducted at the Department of Process Engineering focuses on the recovery of valuable and potentially hazardous metals from waste printed circuit boards. These circuit boards typically contain in the order of 10 – 20% copper and 50 – 200 grams of gold per tonne of waste, which is significantly higher than the valuable metal content of primary metal sources. More specifically, the research is aimed at the development of hydrometallurgical process routes for metal recovery.

Hydrometallurgical metal recycling processes typically entail dismantling of circuit boards, size reduction, physical separation of non-metals/ferrous metals/non-ferrous metals, successive leaching stages and finally recovery of metals from the leach solutions. The metal dissolution is usually done in a two-stage leaching process consisting of oxidative acid leaching of base metals followed by cyanide or halide leaching of precious metals. The research projects that the Department are involved with can be broadly classified as follows:

- Investigation of the interaction between the different unit operations to optimise the integrated process design;
- Evaluation of alternative leaching reagents (which are less hazardous than the mineral acids, cyanide and/or halides currently being used) and subsequent recovery of metal using ion exchange or solvent extraction; and
- Quantification of the economic potential and environmental sustainability of different processes.

The above-mentioned research activities could potentially assist in the establishment of a waste treatment industry in South Africa capable of treating waste circuit boards economically. The research is funded by the National Research Foundation of South Africa, the DST/CSIR Waste Research, Development and Innovation Roadmap, as well as the South African Minerals to Metals Research Institute.

RESEARCH THEMES

The Department of Process Engineering and its Centre for Process Engineering has 16 full-time academics, six extraordinary professors and several researchers and post-doctoral fellows. The main areas of research include:

Mineral Processing

As ore bodies become harder to mine and their grade decreases, the challenge intensifies to develop more efficient processes for metal recovery. The Mineral Processing group's research focuses on process modelling and development, primarily in the areas of hydrometallurgy, pyrometallurgy and physical processing. Most projects are industrially relevant and sponsored, and range from fundamental studies to process development. Experimental investigations, supported by theoretical analysis, assist the development of new and low-energy hydrometallurgical processes for the recovery of both precious and base metals. Techniques such as computational fluid dynamics are used to simulate and investigate processes and complement the well-equipped pyrometallurgical facilities in the Department.

Process Monitoring and Systems

Industrial processes generate a wealth of measurements which can be harnessed to maintain and improve the efficiency of systems. The Process Monitoring group's research activities include the development of new process measurement systems, research on novel methods with which to extract informative features from data and investigation into data-driven approaches for root cause analysis of abnormal behaviour on plants. The group aims to marry industry needs with cutting-edge academic insight. Techniques employed include image processing, statistical learning and process modelling, while research on soft sensor development is often supported by experimental investigation.

Recovery of valuable chemicals from recycled tyres

Degradation and separation processes for the recovery of chemical products from waste tyres are being developed, together with economic assessment of alternative processes. The research is in collaboration with the waste tyres recycling industry.

Separations Technology

The separation and final purification of chemical compounds can be one of the most energy-intensive activities in a chemical manufacturing process. To optimise separation processes, intricate knowledge of the hydrodynamics and mass transfer of the system is required, as well as detailed understanding of the underlying thermodynamics and kinetics of the processes involved. The Separations Technology research group focuses on the overall process behaviour and the fundamentals of phenomena occurring during separation. This group works in close collaboration with industry and studies processes such as distillation of petroleum compounds, CO_2 sequestration, supercritical fluid extraction, membrane separation and water purification.

Bioprocess Engineering and Biorefineries

Bioprocess engineering research is directed towards the application of chemical engineering principles in the development and optimisation of biological processes. A range of biological processes are researched, including those using bacterial, fungal and enzymatic catalysts for the bioconversion of raw materials. Biorefineries are a focus, targeting the replacement of fossil fuels with renewable material for the production of fuels and chemicals. Biological, chemical and thermo-chemical technologies are used to convert plant materials into valuable products to reduce dependency on fossil fuels and to decrease carbon emissions. The work is tailored to ensure commercial application of the technologies, in collaboration with sugar, paper and biofuels industries.

CONTACTS

Chairperson
Prof Steven Bradshaw
Mineral processing; Hydrometallurgy.
smb@sun.ac.za

Prof André Burger
Separations technology; Environmental engineering; Desalination; Water and effluent treatment.
ajburger@sun.ac.za

Prof Johann Görgens
Bioprocess development; Development of biorefineries; Second generation biofuels; Industrial enzyme production; Conversion of waste tyres into chemical products.
jgorgens@sun.ac.za

Prof Guven Akdogan
Pyrometallurgy; Hydrometallurgy; Mineral processing; Materials engineering.
gakdogan@sun.ac.za

Prof Kim Clarke
Engineering biological processes; Hydrocarbon bioconversions; Antimicrobial biocontrol agents; Bacterial biofuels.
kclarke@sun.ac.za

Prof Lingam Pillay
Potable water provision; Wastewater remediation and reuse; Rural water treatment; Membrane technology; Novel water treatment processes.
pillayvl@sun.ac.za

Prof Christie Dorfling
Hydrometallurgy.
dorfling@sun.ac.za

Prof Cara Schwarz
Separations technology; Supercritical fluid extraction; Phase behaviour; Thermodynamics; Conversion of waste tyres into chemical products.
cschwarz@sun.ac.za

Dr Percy van der Gryp
Membrane separations technology; Reaction kinetics; Conversion of waste tyres into chemical products.
pvdgryp@sun.ac.za

Dr Raymond Els
Hydrometallurgy; Plant and process design; Project management; Biofuels.
rels@sun.ac.za

Dr Lidia Auret
Process monitoring and systems; Mineral processing; Feature extraction; Fault detection and identification; Applied statistical learning.
lauret@sun.ac.za

Dr Annie Chimphango
Bioprocess engineering; Biorefinery development; Biomass energy systems and sustainability; Conversion of waste into high valuable products; Postharvest engineering. Environmental engineering; Enzyme application.
achimpha@sun.ac.za

Dr Neill Goosen
Aquaculture nutrition; Biological waste utilisation; Bioprocessing.
njgoosen@sun.ac.za

Dr Tobi Louw
Bioprocess modelling.
tmlouw@sun.ac.za

Dr Robbie Pott
Bioprocess engineering.
rpott@sun.ac.za

Dr Margreth Tadie
Hydrometallurgy.
mtadie@sun.ac.za

Ms Sunel Nortjé
Greenhouse gas emissions; Carbon footprinting; Separations technology.
spnortje@sun.ac.za

Mr Petrie van Wyk
Hydrometallurgy.
apvanwyk@sun.ac.za

DEPARTEMENT
SIVIELE INGENIEURSWESE

DEPARTMENT OF
CIVIL ENGINEERING

5 HOOGTEPUNTE

Personeel wat hul doktorsgraad verwerf het, is van links drr Riaan Combrinck, Louis Roodt, André Theron en Isobel Brink.

Personnel who obtained their PhD degree are from the left Drs Riaan Combrinck, Louis Roodt, André Theron and Isobel Brink.

Geborgde leerstoele

Die Departement Siviele Ingenieurswese is besonder trots op drie geborgde leerstoele wat getuig van industrie se sterk ondersteuning asook vertroue in die Departement. Die ondersteuning het reeds in 2001 begin met die totstandkoming van die SANRAL-Leerstoel in Plaveiselingenieurswese met prof Kim Jenkins as bekleër. Die Leerstoel in Hawe- en Kusingenieurswese word reeds sedert 2007 deur die Transnet Nasionale Hawe-owerheid (TNPA) geborg. Prof Koos Schoonees is in 2014 in die Leerstoel aangestel. Die Murray en Roberts Leerstoel in Konstruksie-ingenieurswese en Bestuur is in 2010 ingestel met prof Jan Wium as bekleër. Die goedgevestigde Konstruksiebestuursprogram, wat sedert 1976 aangebied word en internasionale aansien geniet, val ook onder die vaandel van dié Leerstoel.

Hawe- en kusingenieurswese

Die Transnet Nasionale Hawe-owerheid Leerstoel is in 2015 verder uitgebrei tot twee akademici met dr André Theron wat in Junie by die bekleër, prof Koos Schoonees, aangesluit het. Die Leerstoel se hoofdoel is gevorderde opleiding (meestal meestersgrade en nagraadse diplomas) vir werknemers van die Transnet Nasionale Hawe-owerheid asook ander studente. Agt nagraadse modules word aangebied. Die teoretiese aspekte is aangevul deur praktiese ingenieurswese tydens besoeke aan die hawens van Saldanha en Kaapstad. 'n Kortkursus in hawebeplanning en baggerwerk is ook oor vyf dae aan 116 kursusgangers aangebied. Alhoewel die Leerstoel eintlik op nagraadse opleiding fokus, is 'n inleidende kursus ook aan finalejaar Siviele ingenieurstudente gebied wat hopelik groter belangstelling vir die veld op nagraadse vlak sal aanwakker.

Konstruksiebestuursprogram

Die jaarlikse Konstruksiebestuursprogram is vanaf 14 Junie tot 10 Julie in Stellenbosch aangebied. Die 40 afgevaardigdes wat dit bygewoon het, was verteenwoordigers van raadgewende ingenieursmaatskappye, kliënteorganisasies en verskeie konstruksiemaatskappye. Dit is op 20 Oktober opgevolg met 'n Alumniseminaar wat sedert 2012 jaarliks plaasvind. Uitstekende sprekers het daartoe bygedra dat betekenisvolle gesprekke oor transformasie in die konstruksiebedryf kon plaasvind. Bo en behalwe die Konstruksiebestuursprogram het altesaam 138 kursusgangers uit die industrie nagraadse- en industriekursusse bygewoon wat deur die Konstruksiebestuursprogam in 2015 aangebied is. Dit is 'n stewige styging van die vorige jare (21 in 2012; 44 in 2013; en 34 in 2014). Die groot styging is deels te danke aan die suksesvolle aanbieding van twee nuwe kursusse oor die *New Engineering Contract*.

Plaveiselingenieurswese

Die Plaveiselingenieurswesegroep spreek die behoefte aan om volhoubare praktyke daar te stel vir die instandhouding van die Suid-Afrikaanse padnetwerkinfrastruktuur. Te midde van verhoogde omgewingsbewustheid en sosio-ekonomiese uitdagings word holistiese oplossings benodig wat nie werkverrigting inboet nie. Daar is drie navorsingsgebiede in die Departement wat die behoefte direk aanspreek: Koue stabilisering van herwinde materiale; Herwinde boumateriale; en Optimering van dun deklae. Numeriese modelle, insluitend konstitutiewe materiaalmodelle vir individuele seëlkomponente vir verskillende seëllaagsamestellings, is ontwikkel deur gebruik te maak van eindige elementmetodes. Hierdie unieke werk het die eerste numeriese metode met betrekking tot die ontwikkeling van seëllae vir padoppervlaktes gelewer en word ingesluit in die nuwe Suid-Afrikaanse Meganistiese Ontwerpmetode met die doel om seëlgedrag te optimeer en meer robuuste plaveiselontwerpe te skep.

Nagraadse groei

Die Departement se nagraadse programme het die afgelope tien jaar beduidend gegroei. In 2010 was die getal nagraadse registrasies 184 vergeleke met die rekordgetal 297 nagraadse registrasies in 2014. Die volgehoue styging het egter 'n swaar las op die akademici geplaas wat nagraadse studieleiding bied en is daar besluit om nagraadse inskrywings vanaf 2015 meer oordeelkundig te bestuur met strenger toelatingskriteria. Gevolglik was daar in 2015 minder nagraadse registrasies (257) as in die vorige jaar. 2015 was egter 'n uitskietjaar in die Departemente ten opsigte van meesters- en doktorsgrade wat toegeken is (69 meesters; 12 PhD; en twee DIng). Die Departement is ook trots op vier personeellede wat hul doktorsgraad ontvang het, naamlik drr Louis Roodt, André Theron, Isobel Brink en Riaan Combrinck.

5 HIGHLIGHTS

Sponsored Chairs

The Department of Civil Engineering is proud of the fact that it has three sponsored Chairs, which is evidence of industry's strong support and confidence in the Department. This support started as far back as 2001 with the establishment of the SANRAL Chair in Pavement Engineering with Prof Kim Jenkins as incumbent. The Transnet National Ports Authority (TNPA) has funded the Chair in Port and Coastal Engineering since 2007. Prof Koos Schoonees was appointed the incumbent of this Chair in 2014. The Murray and Roberts Chair in Construction Engineering and Management was established in 2010 with Prof Jan Wium as the incumbent. The well-established Construction Management Programme, which has been presented since 1976 and which enjoys international recognition, also falls under the auspices of this Chair.

Port and coastal engineering

In 2015 the Transnet National Ports Authority Chair was extended to two academics when Dr André Theron joined the incumbent of the Chair, Prof Koos Schoonees, in June. The main aim of the Chair is advanced training (mostly master's degrees and postgraduate diplomas) for employees of the TNPA as well as other students. Eight postgraduate modules are presented. The theoretical aspects were demonstrated by practical engineering during visits to the ports of Saldanha and Cape Town. A five-day short course in port planning and dredging was also presented to 116 attendees. Although the Chair's focus is on postgraduate training, an introductory course was also introduced to final-year Civil engineering students with the aim of stimulating interest in this field at postgraduate level.

Construction Management Programme

The annual Construction Management Programme (CMP) was presented at the Stellenbosch campus from 14 June to 10 July. The 40 delegates who attended were representatives from consulting firms, client organisations and a variety of construction companies. A subsequent CMP Alumni Seminar was held in Gauteng on 20 October. This event has taken place every year since 2012. Excellent speakers at this event contributed to meaningful discussions on transformation in the construction sector. Apart from the CMP, a total number of 138 industry participants attended the postgraduate and industry courses offered by the CMP in 2015 (21 in 2012; 44 in 2013; and 34 in 2014). The large increase is partly due to the successful presentation of two new introductory courses on the *New Engineering Contract*.

Pavement engineering

The Pavement Engineering group is addressing the need for sustainable practices in the maintenance of South Africa's road network infrastructure. Amidst increasing environmental consciousness and socioeconomic challenges holistic solutions are needed that do not compromise on performance. Three areas of research within the Department are directly addressing this need: Cold recycling technology; Construction and demolition materials; and Optimisation of thin surfacings. Numerical models, including constitutive material models for individual seal components of different seal configurations, were developed, using finite element methods. This unique work has provided the first numerical model of seals and is being incorporated in the new South African Mechanistic Design System with the role of optimising seal performance and creating more robust pavement designs.

Postgraduate growth

Over the past decade the Department's postgraduate programme grew substantially. In 2010 the number of postgraduate registrations were 184 compared to 297 in 2014. However, this sustained increase placed a heavy burden on academics responsible for student supervision and the Department decided to manage student applications more carefully from 2015 onwards by using stricter admission criteria. As a result there were fewer postgraduate registrations in 2015 (257) than the previous year, but 2015 proved to be a exceptionally good year regarding master's and doctoral degrees awarded (69 master's; 12 PhD; and two DEng). The Department is proud of four of its personnel who received doctoral degrees, namely Drs Louis Roodt, André Theron, Isobel Brink and Riaan Combrinck.

Studente besigtig die Robinson-droogdok in die Kaapstadse Hawe.

Students inspecting the Robinson dry dock in the Port of Cape Town.

FOCUS

The Unit for Construction Materials (UCM)

At the launch of the UCM were from the left: Dr Riaan Combrinck (UCM), Prof Eugene Cloete (Vice-Rector Research), Prof Billy Boshoff (Head UCM), Wibke de Villiers (UCM) and Prof Hansie Knoetze (Dean: Engineering).

The Unit for Construction Materials (UCM) (officially launched in April 2016) strives to be a centre of excellence and a top institute for construction materials in South Africa for teaching, research and consulting. Members include both staff and postgraduate students, with a wide network of local and international collaborators. Student training and teaching is the fundamental function of the UCM, but service to the industry by means of consulting and dissemination of information in the form of seminars is paramount to ensure relevancy.

The UCM is interested in all aspects of construction materials, but the four main focus areas are:

- *Eco-friendly construction materials*
  The objective is to develop new construction materials and to reduce the environmental impact of currently used construction materials. Work is also done on researching more eco-friendly cement-based binder and natural fibres in a cement-based matrix. Alkali activated materials are also investigated as an alternative for conventional concrete.
- *Fibre reinforced concrete*
  Fibre reinforced concrete (FRC) is becoming a more popular construction material due to the positive contribution it makes to concrete. UCM also focuses on the use of macro synthetic fibres and the creep of cracked FRC.
- *Fresh and young concrete*
  Research includes plastic settlement cracking, plastic shrinkage cracking and thermal cracking of fresh and young concrete and is aimed at providing guidelines as well as the understanding needed for the prevention of early age cracking of fresh and young concrete.
- *High performance concrete*
  Research aims to investigate the properties of High Strength Concrete (HSC) using local materials and also to develop mix design methods using these materials.

The Unit for Construction Materials (UCM) is located in the Structural Division of the Civil Engineering Department of Stellenbosch University and has at its disposal 1 500 m² of laboratory space. This includes a large structural laboratory, which is serviced by a 10 ton overhead travelling crane. Adjacent to the structural laboratory is a concrete laboratory, which consists of a sample preparation and mixing area as well as a larger open area.

In addition to the significant laboratory space there is also a variety of testing equipment and machines available to the UCM. Most noteworthy are two universal material testing machines, as well as several servo-controlled hydraulic actuators with capacities ranging between 50 kN and 500 kN. The universal testing machines include a 250 kN machine situated in one of the climate controlled rooms and a 2 000 kN machine situated in the structural laboratory.

www.sun.ac.za/ucm

Structural Engineering

Research on construction materials, steel and concrete structures, structural reliability, the application of civil engineering informatics in general and steel structures in particular, as well as sustainability of the built environment. Research includes design loads for structures to represent extreme wind effects, earthquake excitation, as well as industrial actions like overhead crane forces on support structures. Expertise in principles and application of structural reliability leads to a leading role by personnel in development, revision and calibration of national and international design and construction standards for design limits of failure and serviceability. Research on concrete involves the development of modern cement-based materials, fibre reinforced concrete, improved concrete structural design concepts, and characterisation of structural interaction with loads such as soil settlements, wind and seismicity, as well as liquid retaining structures. Research on concrete structures incorporates eventual implementation in the concrete structural design code and loading code. Sustainability of the built environment including durability of materials and structures, and objective modelling and subsequently minimisation of environmental impact is a recent field in the Department.

Civil Engineering Informatics

Focuses on the needs of the civil engineering practice in an information-driven environment. Application of Information Technology in civil engineering is concerned with collaborative engineering, intelligent modelling of the design process in structural engineering, support systems for engineering management and technical aspects of urban engineering.

Water and Environmental Engineering

Fields include water resources development, flood hydrology, environmental water requirements, river hydraulics, reservoir sedimentation, coastal engineering, port engineering, hydrodynamic reservoir/river water quality modelling, water and wastewater treatment and water services. Research is carried out on the morphology of rivers as impacted on by dams, scour at bridges and other hydraulic structures, the discharge capacity of water transfer tunnels, the measurement of discharge in rivers, the design of fish ladders at obstructions in rivers, the determination of environmental changes in rivers, the layout of pump stations in rivers, design of harbours, coastal processes and coastal sediment dynamics. The subdivision water services focuses on water use, saving of water and also the modelling of sewerage systems.

Transportation and Geotechnics

Research is carried out on road safety and Intelligent Transport Systems (ITS). Road safety research includes road crash causation; the influence of human factors; the role of geometric design; speed; public transport safety, and pedestrian safety factors. Research in ITS focuses on public transport user information, multimodal data base development, appropriate technology applications in developing countries and freeway management information applications for travel time estimation as well as incident management systems. Student-orientated research in pavement engineering includes accelerated testing of asphalt including MMLS testing and beam fatigue tests, environment-friendly bitumen stabilised materials researched using triaxial and fatigue tests, development of a performance-related seal design method for bitumen and modified binders, and a mix design and analysis system of asphalt bases.

Construction Engineering and Management

The focus is on the management and development of multidisciplinary capital projects. It includes an investigation into the skills needed to initiate and manage such projects as well as ways in which these skills can be transferred and developed. The division investigates the use of prefabricated elements and modular construction as well as the way in which it can be used together with *in situ* concrete to accelerate delivery.

www.civeng.sun.ac.za

Waterboukunde en Omgewingsingenieurswese | Water and Environmental Engineering

Chairperson
Prof Kobus du Plessis
Hydrology; Environmental engineering.
jadup@sun.ac.za

Prof Gerrit Basson
Head: Division of Water and Environmental Engineering; River hydraulics and design of hydraulic structures.
grbasson@sun.ac.za

Prof Heinz Jacobs
Director: Institute for Water and Environmental Engineering
Water services planning; Hydraulics.
hejacobs@sun.ac.za

Prof Koos Schoonees
Transnet Chair: Port and Coastal Engineering.
kooss@sun.ac.za

Dr Isobel Brink
Hydrodynamic and water quality modelling of dams and rivers; Water and wastewater treatment; Environmental engineering.
icbrink@sun.ac.za

Dr André Theron
Port and Coastal Engineering.
aktheron@sun.ac.za

Mrs Adèle Bosman
Hydraulics.
abosman2@sun.ac.za

Konstruksie-ingenieurswese en Bestuur | Construction Engineering and Management

Prof Jan Wium
Murray and Roberts Chair: Construction Engineering and Management.
janw@sun.ac.za

Mr Chris Jurgens
Construction engineering and management; Project management.
cj@sun.ac.za

Struktuuringenieurswese en Siviele Ingenieursinformatika | Structural Engineering and Civil Engineering Informatics

Prof Gideon van Zijl
Head: Centre for Development of Sustainable Infrastructure; Computational mechanics; Cement-based materials.
gvanzijl@sun.ac.za

Dr Celeste Viljoen
Director: Institute for Structural Engineering; Reliability and risk analysis.
cbarnardo@sun.ac.za

Prof Johan Retief
Reliability and risk analysis.
jvr@sun.ac.za

Prof Billy Boshoff
Head: Unit for Construction Materials; Concrete materials.
bboshoff@sun.ac.za

Dr Breda Strasheim
Civil engineering informatics; Engineering management; Engineering mechanics.
javbs@sun.ac.za

Dr Gert van Rooyen
Civil engineering informatics; Engineering management.
gcvr@sun.ac.za

Dr Hennie de Clercq
Steel structures.
clercq@sun.ac.za

Dr Trevor Haas
Earthquake engineering.
trevor@sun.ac.za

Mr Etienne van der Klashorst
Steel structures.
evdklash@sun.ac.za

Dr Roman Lenner
Concrete structures; Reliability of structures.
rlenner@sun.ac.za

Mrs Wibke de Villiers
Unit for Construction Materials; Sustainability of the built environment; Masonry structures.
wdv@sun.ac.za

Dr Riaan Combrinck
Unit for Construction Materials; Concrete technology.
rcom@sun.ac.za

Mr Algurnon van Rooyen
Concrete technology; Engineering mechanics.
asvr@sun.ac.za

Mr Richard Walls
Fire engineering; Steel structures; Demolition.
rwalls@sun.ac.za

CONTACTS

Geotegniese en Vervoeringenieurswese | Geotechnical and Transport Engineering

Prof Marion Sinclair
Director: Institute for Integrated Engineering and Technology; Traffic safety.
msinclair@sun.ac.za

Dr Louis Roodt
Roads design; Traffic safety.
ldvroodt@sun.ac.za

Prof Christo Bester
Transportation systems; Traffic safety.
cjb4@sun.ac.za

Prof Fred Hugo
Accelerated pavement testing.
fhugo@sun.ac.za

Prof Kim Jenkins
SANRAL Chair: Pavement Engineering.
kjenkins@sun.ac.za

Prof Johann Andersen
Intelligent transport systems.
jandersen@sun.ac.za

Dr Marius de Wet
Fundamental geotechnics.
mdw1@sun.ac.za

Prof Peter Day
Geotechnical engineering.
peterd@sun.ac.za

Mr Leon Croukamp
Geotechnical GIS applications.
lcroukamp@sun.ac.za

Mrs Chantal Rudman
Pavement engineering.
rudman@sun.ac.za

Ms Nanine Fouché
Geotechnical engineering.
naninef@sun.ac.za

Mrs Megan Bruwer
Intelligent transport systems; Transportation engineering.
mbruwer@sun.ac.za

UITREIKPROGRAMME

OUTREACH PROGRAMMES

Uitreikprogramme

Die Fakulteit Ingenieurswese het verskeie uitreikprogramme om belangstelling in wetenskap, ingenieurswese en tegnologie te prikkel.

'n Vader en seun wat 'n Topleerdersgeleentheid bygewoon het.

A father and son who attended a function for Top Learners.

Die jaarlikse **Opedag** is gemik daarop om leerders en ouers bewus te maak van die interessante wêreld van die ingenieur en die groot verskeidenheid loopbaanmoontlikhede wat die verskillende ingenieursdissiplines bied.
Navrae: Me Tanya Ficker
Tel: +27 21 808 9403, e-pos: tanya@sun.ac.za

Tydens die jaarlikse **Winterweek** kry Graad 11 en 12-leerders 'n goeie idee van die werk van 'n ingenieur deur middel van aanbiedings deur dosente en ingenieurs, asook besoeke aan nywerhede en laboratoria.
Navrae: Me Portia Adonis
Tel: +27 21 808 4203, e-pos: winterweek@sun.ac.za

By die jaarlikse **Vroue in Ingenieurswesemiddag** vind Graad 10 tot 12-dogters, wat goed in Wiskunde en Fisiese Wetenskappe presteer, meer uit oor ingenieurswese as beroep vir die vrou wanneer vroue-ingenieurs, -dosente en -studente hulle toespreek.
Navrae: Mev Avril Ford
Tel: +27 21 808 3614, e-pos: aford@sun.ac.za

Tydens sessies word **Topleerders** (Graad 11 en 12) **en hul ouers** ingelig oor die loopbaanmoontlikhede wat ingenieurswese bied en die Fakulteit se graadprogramme.
Navrae: Mnr Minnaar Pienaar
Tel: +27 21 808 4205, e-pos: mop@sun.ac.za

Ingenieurstudente bied die **Wiskunde Tutorprogram** aan leerders by plaaslike hoërskole met die doel om 'n belangstelling in ingenieurswese by leerders te kweek en om hulle te help om beter slaagpunte in Wiskunde te behaal.
Navrae: Mev Avril Ford
Tel: +27 21 808 3614, e-pos: aford@sun.ac.za

Senior studente volg 'n module in leierskap by die **Frederik van Zyl Slabbert Instituut vir Studenteleierskapsontwikkeling** wat hulle in staat stel om goed-afgeronde ingenieurs te word wat beter toegerus is om 'n verskil in die samelewing maak.
Navrae: Mev Avril Ford
Tel: +27 21 808 3614, e-pos: aford@sun.ac.za

Die **TRAC-program** gebruik gerekenariseerde stelsels in TRAC-laboratoria landswyd om leerders te help om wetenskapsbeginsels baas te raak. Dit bemagtig en motiveer leerders om beroepe in die wetenskappe, ingenieurswese en tegnologiese rigtings te volg.
Navrae: Mev Debbey Olivier
Tel: +27 21 808 4384, e-pos: debbey@sun.ac.za

Minquiz (gereël deur Mintek) is 'n wetenskap en tegnologievasvra vir Graad 12-leerders wat loopbane in wetenskap en tegnologie, veral in mynbou, mineraalprosessering en geologie, bevorder. Die Departement Prosesingenieurswese bied ondersteuning in die Boland en die Wes-Kaap.
Navrae: Dr Christie Dorfling
Tel: +27 21 808 3674, e-pos: dorfling@sun.ac.za

Outreach programmes

The Faculty of Engineering has several outreach programmes to stimulate interest in science, engineering and technology.

'n Opedag demonstrasie.

An Open Day demonstration.

The annual **Open Day** is aimed at creating awareness amongst learners and parents regarding the interesting world of the engineer and the vast career opportunities offered by the different engineering disciplines.
Enquiries: Ms Tanya Ficker
Tel: +27 21 808 9403, e-mail: tanya@sun.ac.za

During the annual **Winter Week** Grade 11 and 12 learners get a clear picture of the work of an engineer through presentations by lecturers and engineers, as well as visits to industries and laboratories.
Enquiries: Ms Portia Adonis
Tel: +27 21 808 4203, e-mail: winterweek@sun.ac.za

At the annual **Women in Engineering afternoon** Grade 10 to 12 girls, who excel in Mathematics and Physical Sciences, find out more about engineering as a career for women when women engineers, lecturers and students address them.
Enquiries: Mrs Avril Ford
Tel: +27 21 808 3614, e-mail: aford@sun.ac.za

During sessions **Top Learners** (Grade 11 and 12) **and their parents** are informed about engineering as a career and the Faculty's degree programmes.
Enquiries: Mr Minnaar Pienaar
Tel: +27 21 808 4205, e-mail: mop@sun.ac.za

Engineering students present the **Mathematics Tutor Programme** to learners at local high schools to cultivate an interest in engineering amongst learners and to help them to obtain better pass marks in Mathematics.
Enquiries: Mrs Avril Ford
Tel: +27 21 808 3614, e-mail: aford@sun.ac.za

Senior students follow a **leadership module** at the **Frederik van Zyl Slabbert Institute for Student Leadership Development**, which enables them to become well-rounded engineers who are better equipped to make a difference in society.
Enquiries: Mrs Avril Ford
Tel: +27 21 808 3614, e-mail: aford@sun.ac.za

The **TRAC Programme** enables learners to master science principles by means of computerised systems in TRAC laboratories countrywide. This empowers and motivates learners to follow careers in the sciences, engineering and technological fields.
Enquiries: Mrs Debbey Olivier
Tel: +27 21 808 4384, e-mail: debbey@sun.ac.za

Minquiz (organised by Mintek) is a science and technology quiz for Grade 12 learners that promotes careers in science and technology, especially in mining, mineral processing and geology. The Department of Process Engineering provides assistance in the Boland and the Western Cape.
Enquiries: Dr Christie Dorfling
Tel: +27 21 808 3674, e-mail: dorfling@sun.ac.za

Posadres
Fakulteit Ingenieurswese
Universiteit Stellenbosch
Privaat Sak X1
Matieland 7602
Suid-Afrika

Straatadres
H/v Banghoekweg en Joubertstraat
Stellenbosch

Telefoon | Faks
T: +27 21 808 4203
F: +27 21 808 4206

Koördinate
33˚ 55′ 45″ S
18˚ 51′ 54″ O

Web
www.eng.sun.ac.za

Postal address
Faculty of Engineering
Stellenbosch University
Private Bag X1
Matieland 7602
South Africa

Street address
Cor. Banghoek Road and Joubert Street
Stellenbosch

Telephone | Fax
T: +27 21 808 4203
F: +27 21 808 4206

Coordinates
33˚ 55′ 45″ S
18˚ 51′ 54″ E

Web
www.eng.sun.ac.za

Redakteur | Editor
Liesel Koch

Ontwerp & Uitleg | Design & Layout
Soretha Botha, Grafixit