



UNIVERSITY  
OF ESWATINI

# FACULTY OF *Science & Engineering*



Issue #1

NEWSLETTER



*"The science of today  
is the technology of  
tomorrow"*

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# MESSAGE FROM THE DEAN



It is my privilege to introduce the inaugural issue of the annual Faculty of Science and Engineering (FOSE) Newsletter. We are a “Faculty at work”, and in this Issue we are pleased to share with you some highlights of Faculty activities, events and achievements of members of the faculty. Through the annual newsletters, we aim to keep our alumni, students, university community, friends and partners, abreast with the latest news from the Faculty.

The Faculty has seen a lot of changes in the year 2018 with many staff members retiring and new faces joining. We thank the retired staff members (Prof. P. Egau, Dr. W.H. Liao, Dr. N.D. Silavwe, Prof. M.D. Dlamini, Dr. G. Peter, Dr. N.O. Simelane, Prof. J.I. Matondo and Prof. M. Petrov) for the service they rendered to the Faculty and UNESWA. In this Issue, we welcome and introduce all staff who joined the FOSE in 2018. In the past year, two new undergraduate programmes offered by the Department of Computer Science were launched. The programmes are the BSc in Computer Science Education and BSc in Information Technology. In line with UNESWA's Repackaged Strategic Plan 2018-2021, the FOSE is committed to diversifying its programmes to fill the skills gap in the Kingdom of Eswatini. A few other programmes that will be launched within the next year or two have been developed. Watch this space!

In the year 2018, several FOSE academics received

promotions and some were honoured with national and international awards in recognition of their outstanding contributions in their research fields and for promoting Science through outreach activities. We acknowledge and recognise their achievements and thank them for bringing pride to the Faculty. Six FOSE staff were promoted to the rank of Senior Lecturer, and these are: Dr. G. Bwembya, Dr. D.G. Vilakati, Dr. Z.G. Makukula, Dr. A.S. Metfula, Dr. S.N. Nkambule and Dr. M.A. Malatu. We are also proud of the former Dean of the FOSE, Prof. Justice Thwala, for being appointed as the Vice Chancellor of UNESWA in September 2018. We thank him for the service he rendered to the Faculty. Prof. Thwala served the Faculty of Science and Engineering with commitment and dedication and his elevation to the high office of Vice-Chancellor is well deserved. We are confident that his focus and wisdom will take UNESWA to greater heights.

On the research front, the FOSE remains the top Faculty at UNESWA in terms of research publications. Of note is that publications by the Faculty appear in reputable international journals. The increase in the number of research publications in reputable journals is what the UNESWA's repackaged strategic plan emphasizes. We congratulate the Faculty staff that published in 2018. Their contribution will lead to an improvement in the ranking of UNESWA. We also thank the Faculty staff who represented UNESWA in local and international conferences and workshops. As a Faculty, we recognize the financial challenges faced by the country and UNESWA, particularly with respect to the funding of research activities. We appreciate the resilience of the conscientious Faculty staff who, despite all these challenges, found a way to travel to international conferences to interact with their peers and get feedback on their research work.

Enjoy the news about the FOSE activities in 2018. I wish you a healthy and productive 2019.

*Professor J.J. Matsa*

# NEW STAFF MEMBERS



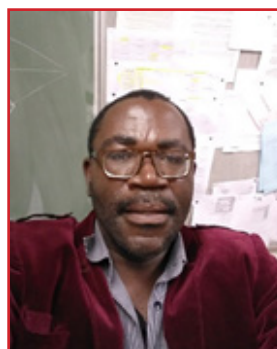
**Prof. Ehab H.E. Bayoumi**

Prof. Ehab H.E. Bayoumi joined the University of Eswatini in August 2018. He obtained a BS from Helwan University, and MS from Ain Shams University, Egypt in 1988 and 1996, respectively. He earned his PhD degree from Cairo University, Egypt in collaboration with Lappeenranta University of Technology (LUT), Finland in 2001. He has been with Electronic Research Institute (ERI) Egypt since 1990. From 2000 to 2001 he joined LUT, Finland as a Visiting Researcher. He was appointed as an Assistant Professor at Chalmers University of Technology (CTH), Sweden from 2003 to 2005. He was appointed as Associate Professor in 2005 and full Professor in 2010 at ERI, Egypt. From 2010-2018, he was on a leave to Saudi Arabia and United Arab Emirates. Currently, he is a Full Professor in University of Eswatini in Electrical and Electronics Engineering Department. In 2013, he was appointed as editor-in-chief for International Journal in Industrial Electronics and Drives (IJIED). His research interests include high performance ac machines, power quality, switching power converters, DSP-based control applications, and nonlinear control applications in power electronics, smart grid and electric drive systems.



**Dr. Godwin C. Ugwunnadi**

Dr. Godwin C. Ugwunnadi joined the Department of Mathematics, University of Eswatini in July, 2018. Previously, he was working at Michael Okpara University of Agriculture Umudike, Nigeria as Lecturer. He obtained his B.Sc. Mathematics from University of Nigeria, Nsukka, Nigeria in 2006 and M.Sc. Mathematics from Bayero University Kano, Nigeria in 2011. He received PhD in Pure Mathematics (Functional Analysis) in 2016 from Ahmadu Bello University Zaria, Nigeria. His main area of research is Operator Theory. In operator theory, he has been working in the area of Fixed Point Theory and Applications.



**Dr. Peter Y. Mhone**

Dr. Peter Y. Mhone joined the University of Eswatini on February 2018. Previously, he was serving at Polytechnic a Constituent College of the University of Malawi as a Senior Lecturer. He obtained his PhD from University of Limpopo, South Africa, and his Master's degree from University of Zimbabwe. His research interests are in probability and its applications in mathematical finance, stochastic control and operations research.



**Dr. Joseph Malinzi**

Dr. Joseph Malinzi joined the University of Eswatini in July, 2018. Previously, he was working at the University of Pretoria as a Postdoctoral Fellow and Assistant Lecturer. He obtained his PhD and MSc from the University of KwaZulu-Natal, South Africa. His research interests broadly lie in the fields of Computational and Applied Mathematics and specifically include Mathematical Biology, Differential Calculus, Data Analysis and Macro Economics.



**Mrs. Nothando B. Sithole-Mandlazi**

Mrs. Nothando B. Sithole-Mandlazi is a patient, conscientious and family oriented woman. She graduated with a degree in Bachelor of Science in 2009 at the University of Swaziland. In 2012 she obtained her Post Graduate Certificate in Education and that qualified her as a teacher at



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Mankayane High School. She then enrolled for Masters of Science in Environmental Resources Management in Environmental Chemistry and Management part time in 2015, and looks forward to graduating soon. She has nurtured young minds in Science and enjoyed participating in netball training until she recently joined the University of Eswatini as a technologist under the Department of Chemistry in February 2018.



Dr. Rose Kibechu

**Dr. Rose Kibechu** is an Analytical Chemistry Lecturer in the Department of Chemistry.

Prior to this position and institution, Dr. Kibechu was a Post-doctoral Fellow at the University of South Africa (UNISA). She undertook her doctoral studies in the department of Applied Chemistry in the University of Johannesburg, South Africa where she also worked as a writing consultants in the Academic development centre (ADC). She has also worked at the Jomo Kenyatta University of Agriculture and Technology (JKUAT), Kenya Technical University, Kimathi University and Mount Kenya University in Kenya as a Part-time Lecturer. Dr. Kibechu has thus far published 6 papers in international peer reviewed journals. Her research

interests fall in the following areas:

- Method development for the analysis and technologies for the remediation of pollutants (emerging contaminants-organic/inorganic) in the environment
- Nanotechnology (graphene, graphitic carbon nitride, nanocomposites)
- Future research interest – modelling and computational chemistry



Dr. Samkele Tfwala

Engineering, MSc in Environmental Resources Management, BSc. in Land and Water Management. While a Ph.D. scholar, he received an outstanding research award for his contribution in the field of sediment transport in rivers. He pursued post doctoral studies in hydraulic structures and sedimentation at National Chung Hsing University in 2016. He became a Lecturer at the University of Eswatini in 2018, and is teaching water resources, water resources planning, drainage basin studies, and land and water resources planning courses. His research interest includes design of hydraulic structures, eco-hydraulics, management of land and water resources, sediment

**Dr. Samkele Tfwala** holds a Ph.D. in Civil Engineering in the field of Soil and Water, MSc. in Soil and Water

dynamics and morphology in rivers, application of Artificial Neural Networks to hydrology and water resources, numerical methods, climate change and water resources, GIS and spatial analysis, inundation and flooding vulnerability assessment, unmanned aerial vehicles in environmental monitoring. He authored several scientific contributions in scientific journals and international conferences.



Dr. Mongi Dlamini

**Dr. Mongi Dlamini** is an experimental high energy/particle physicist in the Department of Physics, UNESWA, and has

just been appointed a tutor in the FOSE. He was recruited by the department as a Teaching Assistant in 2010 and has recently returned, having been away on his training leave since 2011. He did both his Masters and PhD studies at Ohio University, USA. In the broad field of particle physics, his research focuses on studies of the internal landscape of nucleons. One of the outstanding challenges in nuclear, high energy/particle physics today is to infer the dynamics of the ultimate constituents of nucleons and Mongi is part of a huge global research effort to understand this via experimentally measuring functions which provide a three-di-

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mensional tomography of the nucleon's interior. To conduct such studies, scientists in the field use relativistic lepton or ion beams to access and map out the interior of a nucleon. During his stay at OU, Mongi had the privilege to spend a minimum of 3 years at the prestigious Thomas Jefferson National Accelerator Facility (aka Jlab) where he planned, prepared for and eventually conducted his experiment using the facility. He recently (October 2018) rejoined the Physics Department as a Lecturer after successfully completing his program at OU. Mongi's other research interests include computational physics and searches for physics beyond the Standard Model. Outside the sciences Mongi is a staunch Pan-Africanist and has strong interests in post-colonial theories.



**Dr. Sabelo N. Dlamini**

**Dr. Sabelo N. Dlamini** is trained in Epidemiology, Bayesian Geostatistical modelling, Geographic Information Systems (GIS) and Remote Sensing. He has practical skills in GIS and Spatial Epidemiology as well as Bayesian Geostatistical modelling of space-time data. Additionally, he has experience in Sustainable Development particularly in areas such as Environmental Impact Assessment (EIA); Environmental Policy Integration (EPI) and Climate Change. Previous projects include GIS based surveillance capacity building trainings to public health personnel on assignment by the World Health Organisation (WHO) and by the Southern African Development Community (SADC) in countries such as Namibia, Madagascar, Botswana, Mozambique, Zimbabwe and Senegal. He has also been involved in a two year state-of-the art space technology exploration, an FP7 project (MALAREO) aimed at finding innovative ways to use remote sensing and GIS technology in malaria vector control and management. The project was a consortium between Eurosense (Belgium), Remote Sensing Solutions (Germany), Swiss Tropical and Public Health Institute (Switzerland), Medical Research Council, University of KwaZulu Natal (South Africa) and Dr Dlamini represented the National Malaria Control Programme (Eswatini) as a GIS expert (2011-2014). He has also worked for over two years as a member of a scientific committee organising the 9th European Congress on Tropical Medicine and International Health (Basel, Switzerland). His most recent assignments include: developing remotely sensed environmental indices for disease risk mapping and epidemiology for the Copernicus Global Land Project, 2018-2019 (European Commission) as well as mapping of epidemics and acute public health emergencies in the African region on consultancy by the WHO regional office based in Brazzaville, Congo, (2017-2018).



**Mr. Sipho F. Mamba**

**Mr. Sipho F. Mamba** is a human geographer with research interests in rural and urban food security, rural-urban food linkages and urban livelihoods, impacts of climate variability and change on the food system, HIV/AIDS and the poverty-food security nexus. Mr. Mamba also researches on environment and development issues. He holds a Master of Science in Environmental Resources Management (majoring in Land & water), Bachelor's Degree (majoring in Geography & English) and a Post Graduate Diploma in Education and is currently enrolled for a PhD in geography. He is a member of the Young African Statisticians (YAS) and a reviewer for various international peer-reviewed journals. He has also published book chapters and articles in peer-reviewed international journals. He has a great passion for research and enjoys mentoring students on both quantitative and qualitative research methodologies.



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Ms. Bongile Dlamini

Ms. Bongile Dlamini joined the Department of Biological Sciences as a Technologist in July 2018. Prior to her employment in UNESWA she worked at Eswatini Standards Authority for a period of five years. Ms Dlamini has BSc in Molecular Biology and Biotechnology from University of Stellenbosch.



Ms. Nomagcino  
Sibandze

Ms. Nomagcino Sibandze joined the Department of Biological Sciences in August 2018 where she works as a Shorthand Typist/Secretary. Prior to joining the Department, Ms Sibandze worked in the Registry Department of UNESWA.



Ms. Fakazile Dlamini

Ms. Fakazile Dlamini has vast experience in office management. She is motivated and not afraid to show initiative. Ms Dlamini is confident and is an articulate communicator (verbal & written). She is also conversant with MS Office packages, records management, customer relations and event planning, master of managing multiple calendars and meeting booking systems. She worked at UNESWA in the Academic Office from 2014 to September 2018. She joined the Department of Computer Science in August 2018 where she is working as the Secretary of the department. Ms Fakazile Dlamini graduated with a Diploma in Secretariat and Business Studies in 2013 from Ngwane Park Youth & Training Centre, Eswatini. She is also a holder of Certificate in Effective Records, Information and Data Management in 2018 from Mzingeli Trading Skills – Durban, South Africa.

*“Success is a science; if you have the conditions, you get the result. Science is a beautiful gift to humanity; we should not distort it. The science of today is the technology of tomorrow. Science is a way of thinking much more than it is a body of knowledge.”*

# PROMOTED STAFF MEMBERS



**Dr. Gabriel C. Bwembya**

Dr. Gabriel C. Bwembya obtained his BSc degree in Chemistry at the University of Zambia, Zambia and his MSc and PhD degrees in Inorganic Chemistry from the University of East Anglia, England. He joined the Department of Chemistry at UNESWA in 1998 as an Inorganic Chemistry Lecturer.

His research interests are in nutrient analysis of food products, inorganic complexes synthesis and their applications in health, industrial and environmental studies, *Moringa oleifera* studies for the removal of some heavy metals in water and wastewater and agricultural monitoring of pesticides and other environmental monitoring projects. He has published over 20 research articles in international peer reviewed journals. Dr. Bwembya is a reviewer for International Journal of Biological and Chemical Sciences and Applied Organometallic Chemistry. He has supervised six MSc students and is currently supervising seven MSc students. Dr. Bwembya has also been external examiner to two MSc students.



**Dr. Zodwa G. Makukula**

Dr. Zodwa G. Makukula joined the University of Eswatini in 2007 but left in 2009 to pursue her PhD studies at the University of KwaZulu-Natal (UKZN). She completed her PhD, with specialization in Applied Mathematics in the year 2012. She spent a further three years at UKZN working as a

Post-Doctoral fellow in the School of Mathematics, Statistics and Computer Science, before re-joining UNESWA in 2015. Dr. Makukula has published 19 articles in reputable international journals. Her research focus is on the development and application of efficient numerical methods for solving

mathematical models in science and engineering, mathematical biology, and other fields of interest.



**Dr. Gcina D. Vilakati**

Dr. Gcina D. Vilakati joined the Physical Chemistry Section of the Department of Chemistry at UNESWA in July 2015. His specialty is in Physical and Materials Chemistry. His research interest is in drinking and waste water treatment. This includes, but not limited to membrane fabrication and applications in water treatment

and the gap between fabrication and commercialization. In this niche Dr. Vilakati has been able to publish 10 research articles in international Journals. He is also a regular reviewer for a few journals including the Journal of Membrane Science. He has supervised (to completion) seven undergraduate students and is currently the promoter of three MSc students. Last but not least, Dr. Vilakati has examined one PhD Thesis.



**Dr. Andile S. Metfula**

Dr. Andile S. Metfula is the Head of the Computer Science Department housed under the Faculty of Science and Engineering. His passion is in Information Systems and Innovation. In the past few years, his team in the Department has been able to organise the first ever ICT Fair in the country, introduced two

new BSc degree programmes, established a working relationship with the University, Royal Science and Technology Park (RSTP) and the University of Essex to set up the 1st Innovation Lab (iLab) in Eswatini, hosted the 1st Deep Learning (Machine Learning) IndabaX workshop in the Kingdom of Eswatini,



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publish monthly newspaper ICT supplements and the schools' ICT outreach programme. In addition to that, the Department resuscitated the CISCO/CCNA Academy at the University of Eswatini. Dr. Metfula has a Ph.D. from the University of Cape Town (South Africa), an MSc. from Rensselaer Polytechnic Institute (USA) and a BSc. from the University of Swaziland (now University of Eswatini).



Dr. Mengistu A. Mulatu

Dr. Mengistu A. Mulatu obtained his BTech in Electrical Engineering from the Defence University College, Debre Zeit, Ethiopia in 2002 and an MSc in Electrical Engineering from the University of Addis Ababa, Ethiopia in 2007. From December 2002 to July 2008, he was at the Defense University College, and Menschen fur Menchen Foundation, Ethiopia. From August 2008 to January 2012 he was a Lecturer at the Institute of Technology at the Haramaya University, Ethiopia. He obtained his PhD in Electrical Engineering from the National Taiwan University of Science and Technology, Taiwan in 2015. He joined the Department of Electrical and Electronic Engineering at the University of Eswatini in November 2015. His research interests are in the areas of cooperative communications and system optimization for green wireless communications.



Dr. Sifiso M. Nkambule

Dr. Sifiso M. Nkambule obtained his Doctor of Philosophy degree, in Theoretical Physics, in May 2016 at Stockholm University, in Sweden. His research interests are in the area of Computational Molecular Physics, but extend to Material Science. Dr. Nkambule has published eight scientific articles so far. In 2018, he attended two scientific conferences, namely; 2018 Joint ICTP-IAEA School and Workshop on Fundamental Methods for Atomic, Molecular and Materials Properties in Plasma Environments, which was held in Trieste, Italy, in April, and the Next Einstein Forum Global Gathering, which was held Kigali, Rwanda, in March.

*“Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the world.”*

*- Louis Pasteur*

# AWARDS, APPOINTMENTS AND HONOURS



## Faculty Celebrates Prof. Justice Thwala's Appointment as Vice Chancellor of UNESWA



Prof. Thwala with the Acting Dean of the FOSE at the farewell function in his honour

The Faculty of Science and Engineering takes great pleasure to have one of its own, our former Dean, Professor Justice Thwala being appointed the Vice Chancellor of UNESWA. Prof. Thwala is an Associate Professor of physical and environmental chemistry. A brief history of his career

and leadership growth over the years, he first joined the Chemistry Department as a Teaching Assistant, before being appointed as a Lecturer in 1989. Then in 1991, he was promoted to the rank of Senior Lecturer, and then to the rank of an Associate Professor in 2015. He has served the Faculty as Tutor, Head of Department and, until his new appointment, as Dean.

May we take this opportunity to say congratulations Prof. Thwala, on behalf of the whole FOSE family!



FOSE Staff during the farewell function of Prof. Thwala

## Founding Members of the Kingdom of Eswatini Academy of Science



Prof. Thwala receiving a certificate during the ceremony

In recognition of their distinguished and continuing achievements in research, Prof. Ara Monadjem, Prof. Justice Thwala and Prof. Sandile Motsa were selected to be among five Founding Members of the Kingdom of Eswatini Academy of Sciences (KEAS). The Academy was launched by the Ministry of Information, Communications and Technology (Department of Research, Science, Technology and Innovation) on the 27th of November 2018, at the Royal Swazi Spa, Ezulwini. Prof. Priscilla Dlamini (Director of SIRMIP) and Prof. Lydia Makhubu (former UNESWA Vice Chancellor) were also selected to be among the cohort of five Founding Members of the KEAS. The key objective of the Academy is to promote science and encourage independent scientific thinking in society.





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## Prof. Sandile Motsa Elected SAMSA President



Prof. Motsa at the SAMSA Conference

In November 2018, at the conclusion of the 37th Regional Conference of the Southern Africa Mathematical Sciences Association (SAMSA), Prof. Sandile Motsa was elected as the

new president of the Association. The Conference was hosted by Botswana International University of Science and Technology (BIUST) in Botswana. SAMSA is an association whose objective is to further research and teaching of Mathematical Sciences in Southern African countries and beyond through holding of conferences, workshops, academic exchange visits and research schools. Before becoming president, Prof. Motsa was Vice-President of SAMSA from 2014 to 2018.

## Dr. Vusi M. Magagula Selected to be Part of the HLF Forum, Heidelberg, Germany

Dr. Vusi Magagula was selected to be part of the 6th Annual Heidelberg Laureate Forum which was held in Heidelberg, Germany (22nd – 29th September 2018). In this forum, young researchers in computer science and mathematics from all over the world apply for one of the 200 coveted spots to participate in the Heidelberg Laureate Forum (HLF), an annual networking event. The HLF offers all accepted young researchers the great opportunity to personally interact with the laureates of the most prestigious prizes in the fields of mathematics and computer science. For one week, the recipients of the Abel Prize, the ACM A.M. Turing Award, the ACM Prize in Computing,

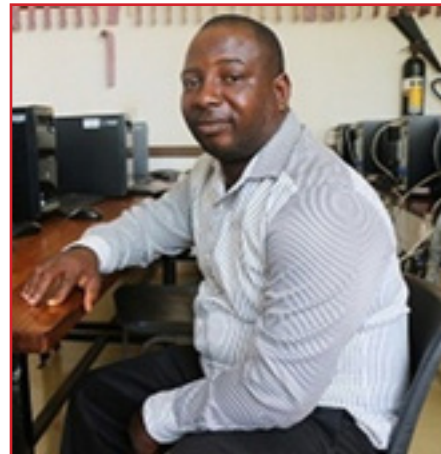
the Fields Medal, and the Nevanlinna Prize engage in a cross-generational scientific dialogue with young researchers in Heidelberg, Germany. It is a prominent, versatile event that combines scientific, social and outreach activities in a unique atmosphere, fuelled by comprehensive exchange and scientific inspiration. Laureate lectures, young



Dr Magagula at the Heidelberg Laureate Forum that was held in Germany

researcher workshops and a structure welcoming unfettered discussions are the elements that compose the Forum's platform.

## Best Paper Award in IEEE-IST Conference (IST-Africa), 2018



Dr. Stephen G. Fashoto got the Best Paper Award in IEEE-IST 2018 Conference (IST-Africa). The conference was held in Gaborone, Botswana from 9th – 11th May 2018. The conference paper

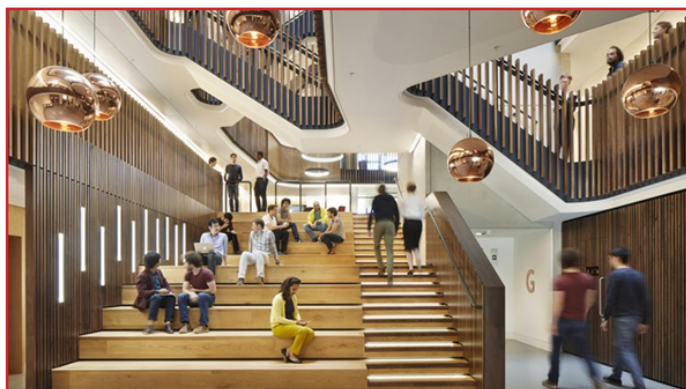
developed an Expert System for Malaria Diagnosis using the Fuzzy Cognitive Map (FCM) Engine. Concepts and causalities were defined based on the experiential knowledge from 30 physicians in 3 hospitals in Nigeria, who served as knowledge sources for this study. The semantic relationships among concepts were utilized in constructing an FCM model for malaria diagnosis, which was further integrated into a decision support engine (DSE).

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The comparative summary showed that the initial hypotheses (IH) by the physicians correctly matched the final diagnosis in 55% of the cases, whereas the accurate diagnosis (AD) of the FCM was 85%.

## Africa-Oxford Travel Award



Dr. Mkhonta with researchers at the newly revamped Rudolf Peierls Physics Building at the University of Oxford  
Picture courtesy: Jack Hobhouse

Dr. Simiso K. Mkhonta visited Prof. Julia Yeomans Group in Oxford for three weeks from 3rd June to 27th June 2018, after receiving the Africa-Oxford Travel Award of £2300. The purpose of the visit was to initiate a research collaboration with Julia's Group, modelling of collective motion of self-propelled particles such as bacteria and other micro-organisms under different environments. The University of Oxford, under the Africa-Oxford Travel Initiative, offers travel grants and fellowships to researchers from the African continent, and the application process is open all year round to all disciplines. For colleagues who may be interested, more information is available in the link: <http://www.afox.ox.ac.uk/grants/>

## Bill and Melinda Gate Foundation Travel Grant

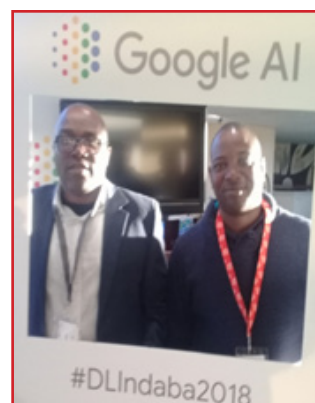
Dr. Stephen G. Fashoto won a Bill and Melinda Gate Foundation Travel grant to attend Keystone Symposia conference on Leveraging Genomic Diversity to Promote Animal and Human Health in Kampala, Uganda from 25th to 29th November 2018.

He presented a poster titled 'Evaluation of Genetic Test Screening on Epidemiology of Prostate Cancer in Swaziland: A Systematic Study of Mutated Genes and Causal Factors'.



Participants of the Keystone Symposia Conference that Dr. Fashoto attended

## 2018: Indaba Travel Award to Dr Stephen G. Fashoto and Mr. Enock L. Dube



Dr Stephen G. Fashoto and Mr. Enock L. Dube, from the Department of Computer Science at the University of Eswatini were awarded the 2018: Indaba Travel Award to attend a Machine Learning Workshop at Stellenbosch University, South Africa, from the 9th to 14th of September 2018. About 550 people, from all over the African continent, attended the event. The Deep Learning Indaba (DLI) exists to celebrate and strengthen machine learning in Africa through state-of-the-art teaching, networking and policy debate. With the aid of its sponsors, industry partners and academia, the DLI works towards the vision of Africans becoming critical contributors, owners, and shapers of the coming advances in artificial intelligence (AI) and machine learning (ML). The theme for the 2018 DLI: Masakhane - meaning 'we build together', was Inspired by a speech given by Nelson Mandela in 1995.



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## Dr. Sifiso M. Nkambule Appointed to be NEF Ambassador



Dr. Nkambule hoisting the Eswatini flag high at the Next Einstein Forum (NEF) where he was appointed as the NEF Ambassador for Eswatini

Dr. Sifiso M. Nkambule has been appointed as the Next Einstein Forum (NEF) Ambassador for Eswatini, for the year 2017-2019. Launched in 2013, the NEF is an initiative of the African Institute for Mathematical Sciences (AIMS) in partnership with Robert Bosch Stiftung. The

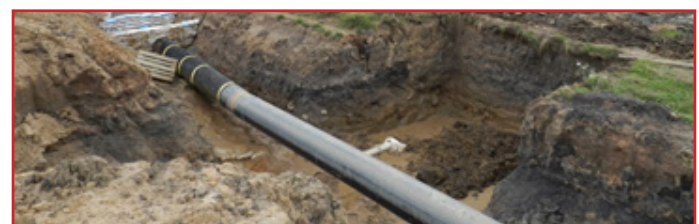
NEF is a platform that connects science, society and policy in Africa and the rest of the world. Its goal is to leverage science for human development globally. The NEF believes that Africa's contributions to the global scientific community are critical for global progress. At the centre of NEF efforts are Africa's young people, the driving force for Africa's Scientific Renaissance. Dr Nkambule has been tasked to champion NEF goals in Eswatini. As a result, in September 2018, he chaired a committee that successfully organised and launched the first ever Science week in the Kingdom of Eswatini. He initiated an outreach program in the Physics Department called the Physics Show, and in 2018 visited eight schools in the country.

## Prof. Heinz Beckedahl Appointed Advisor and Wetland Specialist to the Umgeni Water Mooi River – Mpofana Pipeline Project



A rehabilitated section of the pipeline (slightly greener) being irrigated to ensure that the seedlings take root during a dry period

Prof H. Beckedahl was in May 2018 appointed as advisor & wetland specialist to the Umgeni Water Mooi River – Mpofana Pipeline project for rehabilitation of wetlands impacted during the construction of this pipeline. This is a 16 km long water pipeline in the Mpofana district of KwaZulu Natal, South Africa, bringing potable water to impoverished communities of the area. This 60cm diameter pipeline crosses 14 wetlands through a trench 5m deep and 2m wide, which must be rehabilitated to the norms and standards laid out by both the Department of Water and Sanitation (DWS), and the Department of Economic Development, Tourism and Environmental Affairs (EDTEA). This will continue to the end of 2019.



The open trench showing the pipeline

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## More Faculty Awards, Appointments & Honours

**Dr W.M. Dlamini** was in May 2018 appointed through SWASA to be a member of the International Standards Organization (ISO)'s Technical Committee on Geographic Information/ Geomatics (TC211). This committee is responsible for global geographic information standards on methods, tools and services for data management (including definition and description), acquiring, processing, analyzing, accessing, presenting and transferring such data in digital/ electronic form between different users, systems and locations.

\*

**Dr W.M. Dlamini** was in April re-appointed to be a member of the Institute of Electrical and Electronics Engineers (IEEE) Image Analysis and Data Fusion Technical Committee. This committee of the IEEE Geoscience and Remote Sensing Society serves as a global, multi-disciplinary, network for geospatial data fusion, with the aim of connecting people and resources, educating students and professionals, and promoting the best practices in data fusion applications.

\*

**Dr M. Mlipha** was appointed as the lead judge of the 2nd edition of the National Temvelo Awards hosted

by the Eswatini Environment Authority (EEA) held in June 2018 at the Convention Centre, Ezulwini. Different entities put their core activities and business initiatives for assessment in the various environmental categories that include sustainability, climate change (levels carbon and other harmful gases emission), energy efficiency, water management, social responsibility and adaptability.

\*

**Dr M. Mlipha** was also appointed as a leader of the panel judges in the 2018 Annual Competition of the SADC Energy and Power generators. The competition involved mainly presentations of reports on environmental and sustainability projects implemented by the various power utilities or energy agencies in the SADC region. It is hosted on rotational basis and in 2018 it was the turn of the local energy agency, Eswatini Electricity Company (EEC) to host the event. The competition was held in May 2018 at the Convention Centre, Ezulwini.

\*

**Prof Beckedahl** has been appointed as an extraordinary (i.e. honorary) member of staff in the Department of Geography, Geoinformatics & Meteorology of the University of Pretoria.

\*

**Dr M. Mlipha** was appointed as a member of the Land Degradation Surveillance Framework (LDSF)

Steering Committee. The LDSF is a framework designed to provide a biophysical baseline at landscape level, and a monitoring and evaluation framework for assessing processes of land degradation and the effectiveness of rehabilitative measures over time.

\*

**Dr S.D. Mabaso** and **Dr. W.M. Dlamini** were appointed as members of the Eswatini Land Degradation Surveillance Framework Technical Committee. The Committee is tasked with planning and supervising the undertaking of the LDSF project nationally, currently housed and led by ESWADE. The project entails the undertaking of a field survey and a sampling protocol on 13 sites systematically spread across the country, in order to establish a national biophysical baseline.

\*

**Dr S.D. Mabaso** was in November 2018 appointed as a member of the Eswatini's World Soil Day Organising Committee. This Committee was constituted in order to organise a symposium that was held on the 14th December 2018, meant to raise a national awareness on soil pollution, which was the sub-theme for the 2018 celebration.



# SCIENCE WEEK

## Eswatini Host the First Ever National Science Week

The Kingdom of Eswatini had a wonderful privilege of hosting the first ever science week in the country on 24 September to 28 September 2018. Led by the Next Einstein forum (NEF) Ambassador in Eswatini, Dr Sifiso M. Nkambule, the Science Week comprised of a wide variety of activities, reaching various members of the societies, from academia, government and private sector. Sponsored and coordinated by the NEF in 35 African countries, the theme of the Africa Science week was “Igniting the power of Science”.

The event was locally organized by a committee, which comprised lecturers from the Faculty of Science and Engineering at the University of Eswatini (UNESWA). Departments of Chemistry, Computer Science, Electrical and Electronic Engineering, Geography, Environmental Science and Planning, Mathematics and Physics at UNESWA took part in the events, together with U-Tech High School, Emergency Medical Rescue College (EMRC), Macmillan Education, the Ministry of Education and Training (MOET), and the Ministry of Information and Communication Technology (MICT). During the week, the events that took place started with regional science expos. The Science Expo was in Shiselweni and Lubombo regions on 24th September and on 25th September it was in Manzini and Hhohho regions. In Shiselweni, it was held at the REO offices in Nhlangano. In Lubombo, it was held at Siteki Nazarene High School. Sydney Williams Primary school was the venue for the Manzini region, while in Hhohho it was held at Peak Central High School. There were 100 pupils who attended in each region and 35 volunteers, from UNESWA, 12 volunteers from U-Tech High School, two representatives from the MICT, and two representatives from the Ministry of Education and Training (MOET).



## Science Expo

At the Science Expo, there were activities, including the science quiz contest, scientific presentations and demonstrations, speeches from Government ministries representatives and announcement of quiz contest winners. The Emergency Medical and Rescue College (EMRC) was also present at the Expo, showcasing their rescue and first aid equipment. They also made presentations on what the College offers to prospective students.



Students from different respective schools participating in the different demonstrations and technologies being showcased

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On the third day, the events focused on reaching tertiary students. There were two main events taking place at the Kwaluseni Campus of UNESWA. The first event was the coding challenge. Ten teams, each comprised of 3-4 members assembled at the FNB Computer Laboratory, in Kwaluseni to compete in coding challenge aimed at solving a current problem, related to mobile money payment of electronic access to local newspapers. The teams were from UNESWA, ECOT, IDM, ECU and Limkokwing University. Limkokwing University, ECU and IDM attained positions three, two and one, respectively.



Personnel from EMRC making a demonstration to a group of students

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## Tertiary Students' Research Presentation Challenge

The second event was the Science Conference. Final year undergraduate students and postgraduate students from UNESWA, Faculties of Social Science,

Agriculture, Consumer Science, Health Sciences, and Science and Engineering were invited to present a summary of their current research to a public audience. Each presentation was three minutes long. This event took place at the Multi-purpose Hall at UNESWA Kwaluseni campus. The three best presentations were awarded prizes and they are;

Position	Name	Title
1	Sakhile Nsibande	Producing animal feed and organic manure from waste produced by hatcheries around Eswatini
2	Gloria Masarirambi	Producing traditional emasi using modern biotechnology
3	Sihle Dlamini	Characterization of various effluents from a sugar mill using conventional and advanced techniques



The three winners posing for a photo with a member of the Faculty, Mr. Mhlaliseni Khumalo

## The Science Indaba

The key event of Eswatini Science week was 'The Science Indaba'. This event drew speakers from academia, government and the private sector, to a celebration of Science in Eswatini. A series of relaxed panel discussion took place. Here the role of Science, Technology, Engineering and Mathematics (STEM), the related challenges, and how best to overcome them in attaining Vision 2022 were discussed. Also



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the relationship between Science and industry was looked into. A journalist from Eswatini TV, Ms Siphesihle Nkwanyana, and the Managing Editor of the Swazi Observer Group of Newspapers, Mr. Mbongeni Mbingo, were invited to facilitate the panel discussions. Mr Siphelele Mhlanga from the Royal Science and Technology Park (RSTP) was the programme director for the day.

Opening remarks were given by Mr Maxwell Masuku, Principal Secretary in the Ministry of ICT, who was representing the acting Prime Minister, Mr Vincent Mhlanga.

There were about 220 attendees in the event with a well representation on gender. The women in the Science Panel was addressing issues based on the following questions; What are the benefits for governments, industry, academia for promoting women in STEM and how will this support the achievement of Building a pipeline into first world status? Does the Kingdom of Eswatini offer unique challenges or opportunities for women in STEM? Why should men care about this issue and what role can men play in promoting Eswatini women in STEM?

The introduction was done by Ms. T Dube, Senior Inspector of Science MOET. Ms Siphesihle Nkwanyana, a Journalist from Eswatini TV was the moderator. The panel speakers included Prof. Nonhlanhla A. Sukati, Professor of Community Health Nursing, University of Eswatini; Mrs Ngwenya, Principal, Good Shepherd High School; Ms. Dudu Masina, Director of Meteorology, Ministry of Environment and Tourism; Prof. Pinky E. Zwane, then Dean, Consumer Science, UNESWA (now PVC Admin); and Ms Turu Dube, Senior Inspector of Science, MoET.



Mr Masuku making his opening remarks



The Vice Chancellor, Prof. Thwala making his remarks during the indaba

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The women in Science panel

The Women in Science panel discussion was followed by selected scientific presentation from prominent Eswatini Scientists. These were 10 minutes presentations and they featured the following; Dr. S.N. Dlamini, Lecturer of GEP, UNESWA; Prof. P. S. Dlamini, Director of SIRMIP, and Professor of Nursing, UNESWA; Dr. T. Dlamini, Executive Director ESERPAC; Prof. M. A. Dube Professor of Agriculture, UNESWA; and Prof. S. S. Motsa, Professor of Mathematics, UNESWA.

The last panel discussion was on The Advancement of Science in Eswatini Through Education - Building a Pipeline into First World Status (2022 dream). The Panel addressed the issues ranging from the following questions; How can STEM research and capacity contribute to a sustainable innovation ecosystem?

What are the Key barriers to improving national food security, technology development, health care? Why should we care about STEM and what role can government and industry play in promoting STEM in the Kingdom of Eswatini?

The Introduction was given by the Vice Chancellor of UNESWA, Professor Justice Thwala and Mr M. Mbingo, Managing Editor at Swazi Observer was the moderator. The panelists included a representative of Principal secretary MICT, Under-secretary MOET, Mr. S. Mhlanga (RSTP), Ms D. Nhlengetfwa (CEO FESBC) , Prof. W. Nhlengetfwa (Vice Chancellor at SANU) and Ms B. Simelane (MD McMillan Education Eswatini)



# ICT FAIR 2018



The Honourable Minister of ICT, HRH Princess Sikhanyiso, touring the fair stands with the VC Prof. Thwala and Dr Andile Metfula, Head of Computer Science Department

The University of Eswatini (UNESWA) together with Royal Science & Technology Park (RSTP), the Ministry of Information and Communication Technology (ICT) and the Ministry of Education and Training realized the need to create ICT awareness in the Kingdom of Eswatini as an economic driver in attaining His Majesty's Vision 2022. The ICT Fair was initiated in 2017, to provide a platform for students, individuals and business players in the ICT industry to get an opportunity to showcase their innovative ideas, products and services to the community. The ICT Fair event allows kids, individuals and students to contest in various competitions such as programming contests, innovation contests and gaming contests to stimulate their ICT passion. In addition to that, professionals in science, technology, engineering and mathematics engage in Information Technology (IT) seminars pertaining current technological opportunities, benefits, challenges, issues and as well as policies. The objectives of the ICT Fair are but not limited to: increase awareness of ICT and adoption by young children to the older generation to keep

up with the new technological trends in the world, encourage ICT Innovations in the country, market ICT companies operating in the country, and promote discourse around topical issues around ICT.

The ICT Fair 2018 event was officially opened by the Honourable Minister of ICT, Her Royal Highness Princess Sikhanyiso on the 16th of November 2018. The event attracted so many exhibitors, sponsors, professionals, captains of the industry and the community. The Honourable Minister of Education-Lady Howard Mabuza closed the ICT Fair 2018 on the 17th of November 2018.



The Honourable Minister of Education, Lady Howard Mabuza listening attentively during her tour

# THE PHYSICS SHOW OUTREACH PROGRAMME



The 2018 Physics Show team

The Department of Physics has initiated an outreach programme, mainly for schools dubbed “*THE PHYSICS SHOW*”, which is offered free of charge. This is a ‘fun’ way of showcasing Physics and its application, and makes every attempt at removing the ‘scary equations’. The aim is to engage more members of the community on the significant role of fundamental Science in our society.

Initiated in 2017 by Dr Sifiso M. Nkambule, the Physics Show team comprises staff from the Department of Physics and the undergraduate students volunteer to present the demonstrations during the show. This is an excellent opportunity for the students to practice their scientific presentation skills. In administering the show, schools are visited and the show is conducted in a class or in the Science laboratory. Alternatively, a school can visit the Department of Physics at UNESWA and the show can be conducted in one of the Physics laboratories. The show can be freely booked by any group

in the Eswatini community.

The primary aim of the Physics Show is to spread the joy of science and, in particular, Physics. Physics is more and more than dry equations on a blackboard. It exists everywhere in our everyday lives and is the background to society’s development. We aim to do really fun experiments, demonstrating basic Science concepts, from momentum transfer, wave propagation, magnetism, etc. The aim is to attach great importance to the fact that all our demonstration efforts are explained thoroughly and incredibly with a little basic knowledge. Our main target audience are primary and high school going children, although the show could possibly be adapted for an older audience, like college students and the general public. The ultimate goal is for students not to learn to calculate a lot of things by looking at a Physics Show, but to provide an intuitive understanding of a variety of phenomena and create the much needed enthusiasm for the subject in the country.

In the year 2018, the Physics Show demonstrations were made in eight schools, and the experiments that were demonstrated included the following:

1. *The collapsing soda can*; this is a quick demonstration on the significance of atmospheric pressure.

2. *Centre of mass*; by filling a soda can to three different levels with water, we demonstrate how the centre of mass of an object can be altered.

3. *Momentum wheel*; by using a bicycle wheel, a simple demonstration shows how the centrifugal force, acts in the same vector as the gravitational force to balance the rotation wheel.



4. *Two balloons experiment*; the thermodynamic concept of work and pressure is demonstrated by two balloons at different air pressure.

5. *Laser waterfall*; using the total internal reflection of water, a laser beam is propagated and bent in a waterfall

6. *Vacuum cleaner*: using a simple fan model, the experiment demonstrates the principle of operation of a vacuum cleaner or a vacuum pump.

7. *Candle under water*: this demonstration illustrates the concepts of combustion.



# CENTRE FOR SUSTAINABLE ENERGY RESEARCH



Dr Mathunjwa, the Coordinator for the Centre for Sustainable Energy Research

The Centre for Sustainable Energy Research (CSER) has been established by the University of Eswatini in the Faculty of Science and Engineering to strengthen the capacity of energy sector actors in Swaziland, in order to contribute actively towards amongst other things replication and scaling up of successful sustainable energy technologies, promoting the development and adoption of modern energy policies and management practices, fostering increased access to energy services for socio-economic development, advancing environmental resilience, training and accrediting energy sector practitioners, testing and certifying energy related products and establishing a data repository on energy and related matters.

## Mission

To conduct teaching and research on energy matters, enhance the capacity of actors in the energy sector,

enabling the development and implementation of sustainable energy technologies, policies and management practices, thereby increasing access to energy services for socio-economic development in Eswatini and the region.

## Events Associated with Centre

*May 8th, 2018:* Dr Mduduzi M. Mathunjwa appointed by the Vice Chancellor as the Coordinator for the Centre.

*August 2018:* Two weeks training on wind and solar data modelling for Mr. Thokozani Khumalo (Technologist in the Department of Physics) and Mr. Lindifa Ngwenya (alumni of the Department of Physics, co-opted from Good Shepherd High School).

*August 2018:* Two week training for Dr Gcina A. Mavimbela on Energy Planning in Mbabane, Eswatini

# SEMINARS/WORKSHOPS/ CONFERENCES HOSTED BY THE FACULTY



## The Department of Electrical and Electronic Engineering Conducts Enriching Engineering Education in Swaziland Seminar

On the 15th of March 2018, the Department of Electrical and Electronic Engineering hosted a seminar themed Enriching Engineering Education in Eswatini, held in the Sport Emporium, Kwaluseni campus. The aim of the seminar was to promote the exchange of experiences and best practices in enterprising education for engineers, scientists and engineering students. It was designed to bring together educators, engineers and managers from industry to discuss how engineering education can be improved in Swaziland. In total, the seminar was attended by 83 participants.

this facilitates exchange of ideas on research and conservation which can help the country to advance its research and conservation efforts.

During the research conference it transpired that the biodiversity in Eswatini is at risk of human over-exploitation and degradation. If no intervention strategies are put in place many species are at risk of extinction. The projected human population increase is expected to exacerbate the degradation of biodiversity in Eswatini. This has the potential to upset the overall ecosystem functioning and negatively affect vital ecosystem services and wildlife population dynamics. In response to this, there is an urgent need for research on the different aspects of the ecosystems in order to establish baseline information on the population dynamics of biodiversity in Eswatini. Such research needs are outlined below as discussed by the delegates at the Eswatini Biodiversity Research Conference



## 3<sup>rd</sup> Annual Biodiversity Symposium

On the 31<sup>st</sup> of July 2018, the Department of Biological Sciences hosted an instalment of their annual Biodiversity Symposium held at Kwaluseni campus. This symposium was hosted in collaboration with University of Florida and Savannah Research Centre. In his opening remarks, the VC acknowledged the importance of this symposium as it brings together key players in research and conservation both from within the Kingdom of Eswatini and abroad. He said



## Department of Computer Science Hosts IndabaX

The Department of Computer Science, with the organizational and financial support of the Deep Learning Indaba consortium hosted Deep Learning IndabaX event on the 6<sup>th</sup> of April 2018. Deep Learning is a branch of Machine Learning that applies deep neural networks to modeling data such as language (labelling sentences as having a positive



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or negative sentiment, finding the main topics in documents, translating between languages), speech (transcribing speech data to text), and images (detecting and labeling objects within images). Machine learning, deep learning, and Artificial intelligence (AI) are some of the fastest growing and most exciting areas for data scientists and engineers to work in. From autonomous vehicles to natural language processing and speech recognition, some of the most disruptive and innovative new technologies are powered by machine learning.

The Deep Learning Indaba has two principal aims: to increase African participation and contribution to the advances in artificial intelligence and machine learning, and address issues of diversity in these fields of science.

The event brought together some 89 attendees: IT enthusiasts, Researchers, Government chief information officers, students and learners, other highly respected Academics from different institutions to review the role of Machine Learning / Deep Learning in promoting interdisciplinary development projects, expand capacity to address current and future development challenges, place futuristic strategies in a digital context. It also provided a valuable networking opportunity and set the stage for further cooperation among professionals, students and learners.



### Visit by Colleagues from the University of Redlands to UNESWA

A delegation from the University of Redlands comprising Professor James Kruger, Professor Eric McLaughlin and Dr Steve Moore visited the GEP Department in May 2018. During this visit, discussions were held with technical personnel in the Ministry of Health regarding an initiative to assist the ministry of Health in establishing a geographic information system (GIS) and the GIS in public health and epidemiological studies. The UoR delegation and the local technical personnel agreed that tuberculosis data would be useful as a starting point for the proposed project.

### Visit by Colleagues from the German Archaeological Institute (Deutsches Archäologisches Institut)

In August 2018, the department welcomed Dr. Lisa Ehlers and Professor Jörg Linstädter from

the German Archaeological Institute (DAI) who came on a consultative visit. This visit was aimed at initiating collaboration on archaeological research and training in the country.

### Visit by UNISA Topology Research Group to UNESWA

The Department of Mathematics was visited by four members of the Topology and Category Theory research group from the University of South Africa (UNISA) on the 5th and 6th February 2018. A two-day seminar was run in which the visitors gave presentations based on their research interests. Among the visitors was Prof. Inderasan Naidoo, the Director of the School of Science, who gave a talk on the Memorandum of Understanding (MOU) that UNISA has with UNESWA. Prof. Naidoo gave useful advice on how UNESWA staff can engage UNISA staff on collaborative research projects. Other talks were delivered by Prof. Temba Dube, Dr Oghenetega Ighedo and Dr Partha Pratim Ghosh who spoke on aspects of Category theory, Point-free Topology and Commutative Rings.

# RESEARCH ACTIVITIES (VISITS, SCHOOLS, WORKSHOPS AND CONFERENCES-OUTSIDE UNESWA)



## Deep Learning IndabaX South Africa, 2018

Dr. Stephen G. Fashoto and Mr. Enock L. Dube, from the Department of Computer Science at the University of Eswatini, attended the second edition of the Deep Learning Indaba which was held from the 9th to 14th of September 2018 at the University of Stellenbosch, South Africa. The 2018 Deep Learning Indaba (DLI) agenda included lectures delivered by world renowned AI and ML practitioners and captains of industry. Major topics covered at the Indaba included: Machine Learning fundamentals, feed-forward networks, convolutional neural networks, recurrent neural networks and reinforcement learning. Practical sessions were conducted to complement the material presented in the lectures and addressed the practical considerations around implementing deep learning models. The practical sessions were conducted on the Google Colaboratory platform, <https://colab.research.google.com>, and were intended to allow participants time to engage with the many tutors, mentors and speakers attending the Indaba. The practical's were implemented in Python and Tensorflow framework. TensorFlow (<https://www.tensorflow.org/>) is an open source software library for high performance numerical computation. Its flexible architecture allows easy deployment of computation across a variety of platforms (CPUs, GPUs, TPUs), and from desktops to clusters of servers to mobile and edge devices. Originally developed by researchers and engineers from the Google Brain team within Google's AI organization, it comes with strong support for machine learning and deep learning and the flexible numerical computation core is used across many other scientific domains.



Dr Dube with other delegates of the Deep Learning IndabaX South Africa, 2018

## Workshop on Land Degradation Surveillance Framework

Dr Sizwe D. Mabaso, Dr Wisdom M. Dlamini, Dr Mandla Mlipha and Mr Mpendulo Mkhonta attended the LDSF workshop hosted by ESWADE from the 28th to the 31st of May 2018, at Bethel Court, Ezulwini. The workshop included two days fieldwork-based training at Mafutseni, which was conducted by specialists from the International Centre for Agroforestry (ICRAF), based in Kenya.



Participants of the LDSF workshop and training that was attended by members of the GEP Department

## 2018 Copernicus Global Land Conference

Dr Sabelo N. Dlamini recently attended a conference in Toulouse, France from the 22nd to 26th October, 2018. The conference was organized within the scope of the European Commission's Framework contract for the operation, evaluation and evolution of the global land component of the Copernicus land service. The conference was jointly organized by the University of Liege (Belgium), in partnership with Meteo France (France), and taking place at the Meteo France International Conference Centre. In the conference, Dr. Dlamini presented his work on the review of remotely sensed data products for disease mapping and epidemiology, which is part of a project paper that has been accepted for publication by the Remote Sensing Journal: Society and Environment. This project aimed to find out which remotely sensed



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Delegates of the 2018 Copernicus Global Land Conference Copyright: Christophe Ciais – Meteo-France

(RS) data products were accessible for disease mapping and epidemiology. The project also documented RS data products for disease mapping and proposed other products that could be incorporated in disease mapping and epidemiology studies.

## Guest Professor the Martin Luther University in Halle, Germany

Prof. Heinz Beckedahl was a Guest Professor at the Martin Luther University (MLU) in Halle, Germany, in June and July 2018, where he lectured a Masters course entitled ‘Landnutzung und Umweltprobleme des südlichen Afrika’ (Land Use and Environmental Challenges in Southern Africa). This is part of a long-standing collaboration that Prof. Beckedahl (and the GEP Department) has with the MLU, spanning more than 10 years.

## Particle-based Methods in Materials Science Workshop

Dr. Simiso K. Mkhonta was invited to give a talk at the workshop entitled “Particle-based methods in materials science”, organized by the International Centre for Mathematical Science in Edinburgh, Scotland. The workshop was held on 23rd to 27th July, 2018. Dr. Mkhonta’s talk was on the ‘Emergence of disordered hyperuniform systems in random pinning potentials’, based on results from his

on-going research on application of computational physics algorithm to discover material with exciting and practical applications.



Dr. Mkhonta with other workshop participants from universities around the world

## Energy Efficiency Policy Workshop

Mr. Thokozani Khumalo and Dr. Mongi Dlamini attended the energy efficiency workshop hosted by the Ministry of Natural Resources and Energy, on the 08th November 2018. In this gathering, which was at the Royal Villas, Ezulwini, participants discussed the final draft of the Energy Efficiency Policy Framework prepared by the ministry in collaboration with both local and international stakeholders including the Renewable Energy Association of eSwatini and the University of eSwatini. The policy provides a framework to enhance the implementation of efficient energy (EE) and energy conservation (EC) measures

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in the country. The policy will ensure energy efficiency considerations play a significant role as an energy resource in the energy matrix of the country. The policy covers national roles towards an energy efficient society, starting with the domestic household and going up to the industrial or commercial scale. Once fully adopted, this policy will go as far as setting the standards for domestic and commercial buildings and appliances to be in line with efficient energy consumption goals of the country.

## COMESA Regional Climate Change Policy Dialogue and Training

Mr. Thokozani Khumalo and Dr. Mongi Dlamini attended the above mentioned workshop in the capacity of the Centre for Renewable Energy at Happy Valley Hotel, Ezulwini, on the 19th to the 23rd November 2018. This workshop was conducted by COMESA and eSwatini was the host nation. The workshop saw the participation of COMESA member states including Comoros, Kenya, Madagascar, Rwanda, Seychelles, Uganda, Zambia, Zimbabwe and of course the Kingdom. The main goal of the workshop was to keep up on progress and status of the implementation of Nationally Determined Contributions (NDCs) by COMESA member states and to build the capacities of member states in the development of projects aligned with the NDCs. NDCs are commitments made by states who are signatories to the Paris Agreement. These commitments reflect targets (set by the Paris Agreement signatories) to reduce Green House Gas emissions. This workshop brought together government and non-government role players involved in the implementation of NDCs.

## Cosmology and Gravitational Physics with Lambda

Dr. Nosiphiwo Zwane attended a three week summer workshop on Cosmological Constant, from the 30th July to 17th August 2018, in Nordita, Stockholm, Sweden. Almost a century ago Einstein's seminal paper 'Cosmological Considerations in the General Theory of Relativity' (2 August 1917) proposed a game changing addition to his theory of general relativity:  $\Lambda$  Lambda, the cosmological constant. Since then, and in particular from the remarkable experimental data gathered during the last two decades, the cosmological constant has gone from a theoretical sideline to a central feature of research in cosmology and quantum gravity, including the effective  $\Lambda$  of inflation, the observed  $\Lambda$  of the late time acceleration of our universe, and the negative  $\Lambda$  of the gauge/gravity correspondence in string theory. The conundrums facing each of these applications of  $\Lambda$  are different, but there are many commonalities, similar open questions, and related tools and techniques. Understanding the role of Lambda is one of the deepest open problems in theoretical physics and cosmology.

The aim of the program was to discuss the most recent developments on the theme of  $\Lambda$  in gravitational physics and relativistic cosmology, with focus on

- black hole physics,
- event horizons, boundaries, and information,
- the accelerating Universe

## Izele Workshop

Members of Staff and graduate students from Department of Biological Sciences attended workshop on Conservation and Eco-tourism. The purpose of the workshop was to advance conservation



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and ecotourism in Eswatini using Izele platform. More specifically, the workshop attendants were introduced and taught how to use Izele as a platform for research output and eco-tourism. To this end, attendants created research pages for their organisations hosted in Izele platform. The Department of Biological Sciences created their page called UNESWA Biological Science Department. This page hosts sub-projects from members of staff in the department. From the website <https://izele.org/> we note that 'Izele is a website for conservation areas and conservation groups to share news, information and maps with neighbours, visitors, supporters and partners. It lets smaller conservation groups create their own web pages free of charge and all conservation organisations publicise their work and pass on their expertise by becoming part of a bigger network. Izele is currently limited to organisations in eSwatini, Mozambique and South Africa'.

## Hands-On Research in Complex Systems School, Trieste, Italy

Prof. Sandile Motsa, attended the Hands-On Research in Complex

Systems School which was held at the Abdus Salam International Centre for Theoretical Physics (ICTP), in Trieste, Italy, from 16th July 2018 to 27th July 2018. The aim of the School was to provide researchers with interactive experiences of hands-on research involving table-top experiments with computer data acquisition and modelling. Experiments on physical, chemical, and biological systems were carried out using basic digital instrumentation. The laboratory work was complemented by mathematical modelling and data analysis using Matlab scientific software. Participants also took part in professional development coaching in improved scientific communication. Additionally, participants got an opportunity to present their own research in talks and posters. Prof. Motsa was awarded the Jury's Choice Poster award for his poster presentation titled 'Hybrid block linear multi-step methods based on optimal intra-step points'.



## Global Initiatives of Academic Network (GIAN), Bangalore, India

Prof. Sandile Motsa, participated in the Global Initiatives of Academic Network (GIAN) program that was hosted by BMS College of Engineering (BMSCE), Bengaluru, India from 15th January 2018 to 25th January 2018. The GIAN program is an initiative of the Ministry of Human Resource Development, Government of India, aimed at tapping the talent pool of eminent scientists from outside India to encourage their engagement with the institutes of Higher Education in India. Prof. Motsa was invited by BMSCE to deliver lectures and facilitate in workshops under the theme 'Pseudo-Spectral methods and their applications in solving systems of differential equations'.



## Clinic on Meaningful Modelling of Epidemiological Data

Dr. Vusi Magagula attended a two week workshop on Meaningful Modelling of Epidemiological

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Data at AIMS in Cape Town, from the 27th of May to the 10th of June 2018. The clinic targets quantitative scientists, including mathematicians, statisticians, computer scientists, and infectious disease epidemiologists with strong quantitative backgrounds. The applicants are junior researchers based at institutions in the US, Canada, or Africa. Participants engage with meaningful questions about infectious disease dynamics by integrating mathematical models with epidemiological data. Selection of participants is based on the applicant's academic background, the unique perspectives that they bring to the Clinic, and the degree to which the selection committee expects the applicant will benefit from attending the Clinic.



## 11th Annual Research Workshop on Numerical Methods for Differential Equations

Prof. Sandile Motsa, Dr. Zodwa Makukula, Dr. Peter Mhone and Dr. Vusi Magagula participated in the 11th Annual Research Workshop on Numerical Methods for Differential Equations which was hosted by the University of KwaZulu-Natal at its Pietermaritzburg Campus from the 2 to 6 July 2018. The theme of the workshop was Fractional Calculus, Optimal hybrid multistep methods for IVPs and Spectral collocation on overlapping grids: Theory, Computation and Applications. Prof. Motsa and Dr. Magagula were key resource persons at the workshop and gave several lectures on hybrid methods for IVPs and spectral collocation methods, respectively.

## Role of Science and Research in the Promotion of Blue Economy in Africa

Dr. Mandla Mlipha was a panellist on the Role of Science and Research in the promotion of Blue Economy in Africa. This addressed one of the themes of conference of conference involving Institutions of higher education. The conference was titled Sustainable Blue Economy Conference with the main theme being Sustainability, Climate Change and Controlling Pollution. The conference was held at the Kenya International Conference Centre (KICC) in Nairobi, Kenya on November 26<sup>th</sup> – 28<sup>th</sup>, 2018.



Dr Mlipha with Eswatini delegation during the Sustainable Blue Economy Conference held in Nairobi Kenya on 26<sup>th</sup> -28<sup>th</sup> November 2018

## Workshop on Research Trends in Mathematical Modeling and Analysis in Life Sciences

Dr Joseph Malinzi participated in the 2018 workshop on research trends in mathematical modeling and analysis in life sciences. This year's workshop took place from 04<sup>th</sup> – 06<sup>th</sup> October, 2018 and was held at Amanzingwe Lodge and Conference Centre, South Africa. The Department of Mathematics and Applied Mathematics at University of Pretoria organizes an annual workshop that aims at bringing together researchers (faculty, postdocs, postgraduate students, etc.) in Biomathematics to discuss current topics and share emerging research questions in the area. The workshop intends to provide a forum for interactions



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between mathematicians and researchers in biology and life sciences.



Dr Malinzi posing for the lenses with a poster he presented during the workshop

## Advances in Water Treatment Research in South Africa

Four members of the department namely Prof. Justice M. Thwala, Dr. Gabriel C. Bwembya, Dr. Thabile Ndlovu and Dr. Gcina D. Vilakati attended a workshop at the University of South Africa on the 28 February 2018. The theme of the workshop was 'Advances in Water Treatment Research in South Africa'. The workshop featured contributions and discussions from industry, academia, private sector, government and all stakeholders in the integrated Water Resources management area. The keynote speaker was prof. Nel T.S. Chung from the National University of Singapore who presented on 'Water re-use and seawater

desalination: Recent development on forward osmosis, membrane distillation and pressure retard osmosis membranes'.

## 37th SAMSA Conference, Palapye, Botswana

Prof. Sandile Motsa, Dr. Vusi M. Magagula, and Dr. Joseph Malinzi participated in the 37th Conference of the Southern Africa Mathematical Sciences Association (SAMSA) which was hosted by the Botswana International University of Science and Technology (BIUST) at its campus in Palapye, Botswana from 19th to 22nd November 2018. The conference, which is devoted to recent researches in various areas of Mathematical Sciences and its Applications, was officially launched by His Excellency the President of the Republic of Botswana, Dr. Mokgweetsi Eric Keabetswe Masisi. The theme for the 2018 edition of the conference was *Mathematical Sciences: A Catalyst in Driving a Knowledge Based Economy*.



## BIOMATH 2018

Dr Joseph Malinzi participated in the annual international

conference on Mathematical Methods and Models in Biosciences (BIOMATH) which took place from 24th to 29th June 2018 at the Institute of Mechanics of the Bulgarian Academy of Sciences in Sofia, Bulgaria. It is a multidisciplinary meeting forum for researchers who develop and apply mathematical and computational tools to the study of phenomena in the broad fields of biology, ecology, medicine, biotechnology, bioengineering, environmental science, amongst others. BIOMATH 2018 was devoted to recent research in life sciences based on applications of mathematics as well as mathematics applied to or motivated by biological studies.

## Applications of Fluid Dynamics (ICAFD) 2018

Prof. Sandile S. Motsa delivered a Keynote address at the International Conference on Applications of Fluid Dynamics (ICAFD 2018) which was hosted by the Vellore Institute of Technology in Vellore, India from the 13th to 15th December 2018. The conference was jointly organized by Vellore Institute of Technology, in association with the University of Botswana and the Society for Industrial and Applied Mathematics (SIAM), Philadelphia, USA. The aim of ICAFD 2018 was to establish a premier International forum

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that brought together Mathematicians, Mechanical Engineers and Industrial Experts to present the latest achievements and innovations in the areas of Mathematics and Mechanics. The theme for the 2018 edition of the conference was 'Emerging Trends in Applied Mathematics and Mechanical Engineering'. The conference was attended by over 200 scholars and researchers from over 10 countries.



Prof S.S. Motsa taking participants through the paces during the workshop



Prof. Motsa receiving a gift from the conference organisers



Dr. Malinzi with other BIOMATH conference participants



# LIST OF CONFERENCE/ WORKSHOP PRESENTATIONS

1. **Dlamini, W.M.** (2018). Using GIS to address sustainability challenge. Place and Practice of Health Conference, September 28-29, 2018, University of Redlands, Redlands, California, USA.
2. **Dlamini, W.M.** (2018). Stepping forward for sustainability challenges: a geospatial perspective. Swaziland International SHERQ Conference, August 2 - 3, 2018, Royal Swazi Sun Convention Centre, Ezulwini, Eswatini.
3. **Dlamini, W.M.** (2018). Fire in Swaziland: An overview of the past 16 years. Southern African Fire Network Conference, April 15 - 19, 2018, Kruger National Park, Skukuza, South Africa.
4. **Dlamini, W.M.** (2018). Waste Survey Report: Kwaluseni and Malindza/Siteki. SEA/UNIDO/GOS, Mbabane.
5. **Beckedahl, H.** (2018). Erosion in Dispersive Soils. Conference of the AdG (Afrikagruppe Deutscher Geowissenschaftler) - working group of German speaking Geoscientists working in Africa. July 2018, Germany.
6. **Beckedahl, H.** (2018). Rehabilitation of Soil Erosion. Regional Conference of the International Geographical Union in Canada.
7. **Singwane S.S & Beckedahl H.** Community Forest Resource Utilization and Land Degradation. The Conference of the Society of South African Geographers (SSAG). , Bloemfontein, South Africa.
8. **V.M. Magagula, S.P. Goqo** (2018), The dynamics of malevolent code in a network of Computers: A numerical Analysis Approach, SAMSA 2018 CONFERENCE, Botswana International University of Science and Technology (BIUST) 19-23 November 2018
9. **V.M. Magagula,** (2018), The dynamics of the Zika Virus: A numerical Analysis Approach, MMED 2018 CONFERENCE, AIMS, South Africa, Cape Town, 28 May – 10 June 2018
10. **V.M. Magagula** (2018), Solving Ordinary Differential Equations (Boundary Value Problems) using Collocation Methods: Spectral Quasilinearisation methods, Eleventh Annual Workshop, On Computational Applied Mathematics And Mathematical Modeling, 2nd - 6th July 2018, University of KwaZulu-Natal, Pietermaritzburg, South Africa
11. **S.S. Motsa,** Hybrid Block Linear Multi-Step Methods Based on Optimal Intra-step points, Hands-On Research in Complex Systems School, Abdus Salaam International Centre For Theoretical Physics (ICTP), Trieste, Italy, 16 - 27 July 2018
12. **S.S. Motsa, G. Orakwelu** (2018), New results for optimized block hybrid linear multi-step method for first and second order initial value problems, SAMSA 2018 CONFERENCE, Botswana International University of Science and Technology (BIUST) 19 - 23 November 2018
13. **S.S. Motsa, M. Mkhathshwa, P. Sibanda,** Overlapping multi-domain bivariate spectral method for systems of nonlinear PDEs with fluid mechanics applications, International Conference on Applications of Fluid Dynamics (ICAFD 2018) Vellore Institute of Technology, Vellore, Tamil Nadu, India, 13 - 15 December 2018
14. **S.S. Motsa** (2018), Pseudo spectral methods and their applications in solving systems of differential equations, Global Initiatives of Academic Network (GIAN) Course, BMS College of Engineering, Bangalore, India, 15 - 25 January 2018
15. **M. Samuel, S.S. Motsa** (2018), A new multidomain spectral collocation method for solving parabolic partial differential equations, 42nd South African Numerical and Applied Mathematic (SANUM) Conference, Stellenbosch University, Stellenbosch,



South Africa, 4 – 6 April 2018.

16. **S.S.Motsa** (2018), Development and Application of Hybrid Methods for Solving 1st and 2nd Order IVPs, Eleventh Annual Workshop On Computational Applied Mathematics And Mathematical Modeling, 2nd - 6th July 2018, University of KwaZulu-Natal, Pietermaritzburg, South Africa

17. **S.S.Motsa** (2018), Optimal Hybrid Methods for Solving 1st and 2nd Order IVPs, Eleventh Annual Workshop On Computational Applied Mathematics And Mathematical Modeling, 2 - 6 July 2018, University of KwaZulu-Natal, Pietermaritzburg, South Africa

18. **S.S. Motsa** (2018), Trends in Mathematical Computation Tools Impact on teaching and learning, ESwatini Science Week, Next Einstein Forum Africa Science Week (NEF-ASW), 28 September 2018, Sibane Hotel

19. **S.S.Motsa** (2018), SCREENCASTING: Getting up to speed with the technology, Workshop for Creating Blended Learning Course Materials, Maguga Lodge, 9 - 13 July 2018

20. **J. Malinzi, R. Ouifki, A. Eladdadi, D.F. Torres & K.A.J. White** (2018), Mathematical and optimal control analysis of a model for tumour growth under chemovirotherapy, International Conference on Mathematical Methods and Models in Biosciences (BIOMATH 2018). Hosted by the Institute of Mechanics, Bulgarian Academy of Sciences, Sofia, Bulgaria, 24-29 June, 2018.

21. **J. Malinzi et al.** (2018), Optimal control analysis of a model for tumour growth under chemovirotherapy, Workshop on Research Trends in Mathematical Modeling and Analysis in Life Sciences. Hosted by the University of Pretoria, South Africa, Amanzingwe Lodge and Conference Centre, 04-06 October, 2018.

22. **J. Malinzi, R. Ouifki, A. Eladdadi, D.F. Torres**

**& K.A.J. White** (2018), Mathematical analysis of a model for tumour growth under chemovirotherapy, SAMSA 2018 CONFERENCE. Hosted by Botswana International University of Science and Technology (BIUST), 19-23 November 2018

23. **S.N. Dlamini** (2018). Review of remotely sensed data products for disease mapping and epidemiology. Copernicus Global Land Conference, Toulouse, France, 22 - 26 October, 2018.

24. **W.M. Dlamini & S.D. Mabaso** (2018), Municipal and peri-urban waste, and soil pollution in Eswatini. Eswatini World Soil Day 2018 Symposium, themed 'Be the Solution to Soil Pollution'. Hosted by ESWADE, Ezulwini, Eswatini, 14th December 2018.



# LIST OF PUBLICATIONS (2018)

1. Ogunleye, **G.O., Fashoto, S.G., Mashwama, P., Arekete, S.A., Olaniyan, M. & Omodunbi, B.**(2018). Fuzzy logic Tool to Forecast Soil Fertility in Nigeria, The Scientific World Journal, Vol. 2018, Article ID 3170816, 7 pages, 2018. <https://doi.org/10.1155/2018/3170816>
2. Ogunleye, G.O., **Fashoto, S.G., Mbunge, E., Arekete, S.A. and Ojewunmi, T.** (2018). Securing and Monitoring of Bandwidth usage in Multi-Agents Denial of Service Environment, International Journal of Advanced Computer Science and Application, Vol. 9 No.9, pp. 434-445
3. Ogunleye, G.O., **Fashoto, S.G., Fagbunagun, A., Mashwama, P., & Sithole, S.**(2018). Development Of A Real-Time Information System For Prompt Healthcare Delivery In Nigeria, Transylvanian Review, Vol. 1, issue 1
4. Ameen, A.O, **Fashoto, S.G., Ogeh, C., Balogun, A., Mashwama, P.** (2018) Optimization of Artificial Neural Network for Stock Market Price Prediction using an Enhanced Firefly Algorithm, Research Journal of Applied Sciences Vol. 13
5. **Fashoto, S.G., Amaonwu, O. & Afolorunsho, A.** (2018). Development of A Decision Support System on Employee Performance Appraisal Using AHP Model. International Journal on Informatics Visualization, Vol. 2, issue 4, pp. 262 – 267.
6. **Fashoto, S.G., Metfula, A.S., Matsebula, B. & Fashoto, O.Y.** (2018). Multi-Target Regression Prediction on Cervical Cancer for Evaluation of Performance Measures. Asian Journal of Information Technology, Vol. 17, Issue 3, pp. 160-166.
7. **Fashoto, S.G., Ajiboye, P. Owolabi, O. Metfula, A. & Fashoto, O.Y.**(2018). Assessment of the Readiness of Academic Staff of a Tertiary Institution for Performance Evaluation Using A Dynamic Human Resource Information System. African Journal of Computing & ICT, Vol. 11, No.2, pp. 53-75
8. **Fashoto, S.G.,** Ogunleye, G.O. & Adabara, I. (2018). Evaluation of Network and Systems Security Using Penetration Testing in a Simulation Environment. Georgian Electronic Scientific Journals(Computer Science and telecommunication), Vol. 54, issue 2, pp. 91 – 99
9. **Mbunge, E.,** Rugube, T., (2018) Adoption of Smart Grid Framework Which Tracks Power Consumption of Household Appliances in Zimbabwe. American Journal of Operations Management and Information Systems. Vol. 3, No. 1, 2018, pp. 27-32.
10. **Nickson M. Karie** & Victor R. Kebande (2018). Knowledge Management as a Strategic Asset in Digital Forensic Investigations. International Journal of Cyber-Security and Digital Forensics (IJCSDF) Vol. 7 No.1, January -2018, pp 10-20
11. Victor R. Kebande & **Nickson M. Karie**, (2018). A UML-Based Approach for Analysing Potential Digital Forensic Evidence. International Journal of Cyber-Security and Digital Forensics (IJCSDF) Vol. 7 No.4, September -2018, pp 354-362
12. Victor R. Kebande & **Nickson M. Karie**, (2018). Functional Requirements for Adding Digital Forensic Readiness as a Security Component in IoT Environments. International Journal on Advanced Science, Engineering and Information Technology (IJASEIT). Vol. 8 No. 1. April-2018.
13. Victor R. Kebande & **Nickson M. Karie**, (2018). Adding Digital Forensic Readiness as a Security Component to the IoT Domain. International Journal on Advanced Science, Engineering and Information Technology. (IJASEIT). Vol. 8 No. 1. Feb-2018.
14. V.R. Kebande, **Nickson M. Karie**, Ruth D. Wario, H. S. Venter (2018). Forensic Profiling of Cyber-Security adversaries based on Incident similarity measures Interaction Index, International Conference on Intelligent and Innovative Computing Applications. ICONIC 2018-Mauritius



15. V.R KEBANDE, **Nickson M. Karie**, Antonia Michel, S. Malapane, I. Kigwana, H. S. Venter, Ruth D. Wario (2018). Towards an Integrated Digital Forensic Investigation Framework for an IoT-Based Ecosystem. IEEE International Conference on Smart Internet of Things (IEEE SmartIoT 2018) held on 17th-19th, August 2018 at Xi'an, Shaanxi, China.
16. V.R KEBANDE, **Nickson M. Karie**, I. Kigwana, H. S. Venter, Ruth D. Wario (2018). CVSS Metric-Based Analysis, Classification and Assessment of Computer Network Threats and Vulnerabilities. IST-Africa 2017 Conference Proceedings. The International Conference on Advances in Big Data, Computing and Data Communication Systems (icABCD 2018), 2018-IEEE Xplore, Durban, South Africa.
17. **S.S. Motsa**, S.S., I.L. Animasaun, I.L. Bivariate spectral quasi-linearisation exploration of heat transfer in the boundary layer flow of micropolar fluid with strongly concentrated particles over a surface at absolute zero due to impulsive, International Journal of Computing Science and Mathematics, Vol. 9, No. 5, pp. 455 – 473, (2018)
18. Md. S. Ansari, **S. S. Motsa**, and M. Trivedi, A New Numerical Approach to MHD Maxwellian Nanofluid Flow Past an Impulsively Stretching Sheet, Journal of Nanofluids, Vol. 7, pp. 1-11, (2018)
19. R. Behl, A. Saleh Alshomrani, **S.S. Motsa**, An optimal scheme for multiple roots of nonlinear equations with eighth-order convergence, Journal of Mathematical Chemistry, 56(7) 2069-2084, (2018)
20. Maroju, P., Magrenan, A.A., **Motsa, S.S.** I, Sarria, Second derivative free sixth order continuation method for solving nonlinear equations with applications, Journal of Mathematical Chemistry 56(7) 2099 - 2116.
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27. Ramandeep Behl, Alicia Cordero, **Sandile S. Motsa**, Juan R. Torregrosa, Multiplicity anomalies of an optimal fourth-order class of iterative methods for solving nonlinear equations, Nonlinear Dynamics, January 2018, Volume 91, Issue 1, pp 81-112
28. Ramandeep Behl, Alicia Cordero, **Sandile S. Motsa**, Juan R. Torregrosa, An eighth-order family of optimal multiple-root finders and its dynamics, Numerical Algorithms, April 2018, Volume 77, Issue 4, pp 1249 - 1272



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34. Ramandeep Behl, D. González, Prashanth Maroju, **S.S. Motsa**, An optimal and efficient general eighth-order derivative free scheme for simple roots, *Journal of Computational and Applied Mathematics* 330 (2018) 666 - 675
35. T.M. Agbaje, S. Mondal, Z.G. Makukula, **S.S. Motsa**, P. Sibanda, A new numerical approach to MHD stagnation point flow and heat transfer towards a stretching sheet, *Ain Shams Engineering Journal*, Volume 9, Issue 2, June 2018, Pages 233 - 243
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38. R. Behl, A. Cordero, **S. Motsa**, J. R. Torregrosa, An eighth-order family of optimal multiple root finders and its dynamics, *Numerical Algorithms* (2018), Volume 77, Issue 4, pp 1249–1272
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42. **J. Malinzi** and P.A. Quaye (2018). Exact Solutions of Non-Linear Evolution Models in Physics and Biosciences Using the Hyperbolic Tangent Method. *Mathematical and Computational Applications*, 23.3, 35 Doi: doi.org/10.3390/mca23030035
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