DEPARTMENT OF MATHEMATICS & APPLIED MATHEMATICS

UMSAEP UM-UWC Linkage Report
Visit to Kansas City March 16 to March 31, 2019
Development of nonstandard finite difference methods for integro-differential equations arising in population dynamics

Submitted by Dr Justin B. Munyakazi
Senior Lecturer and Deputy Head, Department of Mathematics and Applied Mathematics
University of Western Cape (UWC)

UMKC Host: Prof Majid Bani-Yaghoub
Associate Professor, Department of Mathematics and Statistics,
University of Missouri-Kansas City (UMKC)

The purpose of the visit was to kick-start a long-term collaboration with colleagues in the Department of Mathematics and Statistics at University of Missouri-Kansas. After I had identified common research interests with Prof Bani-Yaghoub, I needed to have face to face discussions with him to get started with collaborative research work. The time period of the visit was 16-30 March 2019 (2 weeks).

Project
The project with title "**development of nonstandard finite difference methods for integro-differential equations arising in population dynamics**" was approved in 2018. While at UMKC, my host and I worked on some aspects of this project. We identified and defined a modeling problem of infection control via environmental decontamination. The research questions were clearly posed and preliminary simulation results were produced. Upon completing simulations and conducting a mathematical analysis of the results thereof, we will write-up a paper to submit for publication. Other problems will be explored gradually.

Other activities
During my stay, my host and I attended an event during which medical researchers gather at Stowers Institute to share some ideas and results of their research. Opportunities for interdisciplinary research collaboration between applied mathematicians and medical researchers were discussed.

Moreover, I attended a seminar presentation by a graduate from UMKC who works at NASA. During her presentation, she explained the need for mathematics and statistics graduate in the work of the NASA. The purpose of the presentation was to make them aware of their employability.

On Friday, March 22nd 2019, I gave a colloquium talk in the Department of Mathematics and Statistics. The title of my presentation was "**a robust finite difference scheme for singularly perturbed systems**". Even though this presentation took place on the last Friday before Spring

Break, it was well attended by graduate students and professors. I thank Dr Xianping Li for organizing the colloquium.

Other considerations

Collaboration between Prof Majid Bani-Yaghoub and myself has effectively commenced. We are busy working on a first collaborative research paper. Staff at International Relations Office of UWC made it easier for me to plan and prepare my trip. Similarly, staff from the University of Missouri provided the necessary information timely to allow better preparation of the trip.

At this time of globalization and internationalization, it is very important for researchers to seek collaboration at national, regional and international levels. Such collaborations increase ones understanding of research trends in specific research domains, enhances interdisciplinary research outputs via complementarity amongst different research expertise and consolidates institutional linkages.

Prior to my visit at UMKC, my research was mostly geared towards designing and analyzing numerical methods for differential equations. My collaboration with Prof Bani-Yaghoub is central in helping me add another layer to my research; that is developing or modifying mathematical models to make them more realistic before designing numerical methods to solve them. This will certainly enhance my graduate students' supervision capacity.

It is worth mentioning that my requirements for conducting research at UMKC during my visit were amply met. An office space with the necessary computer, software and stationery were available upon my arrival. A network account was also set.

Summary

I appreciate the opportunity to participate in the UMSAEP. The program allowed me to interact with colleagues and students (during presentations) at UMKC. In the future, I would like to make use of such opportunities for a longer stay as the focus on research would be maximum hence enhancing research outputs.

I would like to participate in research group collaborations in the UMSAEP. This would be more beneficial in enriching quality and quantity of research outputs but also in affording exposure to both junior and senior faculty and students alike.

Note: I would like to thank Prof Majid Bani-Yaghoub, my host, for providing the necessary logistical support at the beginning and end of my visit but also for hosting me. I immensely benefited from our regular interactions.

Dr Justin Munyakazi