

ACTIVITY REPORTING FORM  
THE IMU Simons African Fellowship PROGRAM

*(Deadline for completion: see grant letter)*

*The progress report should include a brief (one page) activity report prepared by each mathematician supported, listing research in progress, papers published or in preprint form, students and post-doctoral fellows advised and dates spent at a center.*

*After consideration by CDC, the intention is that this activity report and pictures will be made publicly available on the CDC web site.*

*Please attach at least 2 pictures to this report (to be sent by email) which shows you with your host.*

1. Name of the Grantee: Mamadou Abdoul DIOP
2. Country of origin of the Grantee : Senegal
3. Name of the center of excellence visited : University of Cadi Ayyad
4. Name, position and email address of the host: Khali Ezzinbi, Full Professor, ezzinbi@gmail.com
5. Dates of the research visit: 06 September to 25 October 2017

1. Activity report (at least 200 words) Listing research in progress, papers published or in preprint form

In September and October 2017, I visited the Mathematics Department of University of Cadi Ayyad in Morocco to learn more about stochastic functional integrodifferential equations and random dynamical systems.

Stochastic evolution equations (SEEs) have attracted much attention over the last decades because of their practical applications in many areas such as physics, population dynamics, electrical engineering, medicine, biology, ecology, and other areas of science and engineering. Especially, several researchers pay much attention to the existence and uniqueness to SEEs under some kind of weak sufficient conditions.

In the applied mathematics group at Cadi Ayyad University, Prof. Khalil Ezzinbi has been working on deterministic integrodifferential equations, mostly using theory of semi groups.

With my stay in Morocco we have investigated controllability of stochastic integrodifferential equations and also the qualitative and quantitative properties of stochastic differential equations driven by a sub fractional Brownian motion.

- **Approximate Controllability of Stochastic differential equations**

In this work, we show the approximate controllability of a class of integrodifferential deterministic and stochastic control systems. We establish first the approximate controllability for the linear integrodifferential control system. Secondly, we study the controllability of integrodifferential equations (deterministic and stochastic). Our results are principally obtained by using the approach developed in (N. I. Mahmudov, 2003, Approximate controllability of semilinear deterministic and stochastic evolution equations in abstract spaces, SIAM J. Control Optimal, 42, 5, pp. 1604-1622.)

Examples are provided to illustrate the theory. This work has been submitted to the *International journal of control*

- **Stochastic partial functional integrodifferential equations driven by a sub-fractional Brownian motion**

This paper deals with the existence and uniqueness of mild solutions to stochastic partial functional integrodifferential equations perturbed by a sub-fractional Brownian motion with Hurst parameter  $H$  ( $1/2 < H < 1$ ). We use the theory of resolvent operators developed by R. Grimmer in (W. Desch, R. C. Grimmer and W. Schappacher, 1984, Some considerations for linear integrodifferential equations, Journal of mathematical analysis and applications, 104, pp. 219-234) to show the existence of the mild solutions. An example is provided to illustrate the results of this work. This work will be submitted soon at the following journal: *Stochastics*

Without the opportunity to spend time working with the Mathematics Department of University of Cadi Ayyad, especially with Prof. Khalil Ezzinbi, I would not have discovered the close connections between the theory of semi groups and stochastic analysis.

I am pursuing the topic further in my research and hope to include a discussion of the link between the fractional Brownian motion in a future article on "Approximate controllability of stochastic integrodifferential equations driven by a fractional Brownian motion»

I wish to extend my many thanks to the staff at University of Cadi Ayyad, who helped me with all aspects of my research: Professor Khalil Ezzinbi for arranging my visit and all details related to the Fellows program.

The city of Marrakesh is very expensive and the accommodation is very difficult (because the University guesthouse was in refecton during my stay that is why I was obliged to rent a room in a Hotel-apartment near the University).

I have also participated to the International Conference on Applied Mathematics October 19-20, 2017 in Taza -Morocco where I presented a paper entitled:

Controllability of nonlocal impulsive neutral stochastic functional integro-differential equations with delay and Poisson Jumps.

2. Students and post-doctoral fellows advised: We have advised Mamadou Moustapha Dieye,
3. Including a summary statement (1-2 sentences) of major outcome of research visit:

The IMU Simons African Fellowship grant gives me the opportunity to build many contacts with colleagues in Morocco and to much better develop my work. The work's environment that I had in the Mathematics department of Caddi Ayyad University, helped me a lot to achieve many goals. I plan to have many collaborations between my university and Caddi Ayyad University. I hope in the future to be able to host Moroccan visiting scholars in Senegal with the support of IMU Simons African Fellowship. I plan to co-advise Moroccan PhD students with Prof Ezzinbi and have exchange program that could help in the progress of the students.

4. Planned follow up activities and future implications (2-3 sentences)

We have identify three projects on which we will work during 2018:

- Approximate controllability of stochastic integrodifferential equations with fractional Brownian motion
- Existence and uniqueness of stochastic delay differential equations driven by a fractional Brownian motion
- Solvability of stochastic integrodifferential equations

Prof Khalil Ezzinbi will visit us from 18 December 2017 to 28 December 2017

Date: 10 / November / 2017

Signature



Designation: Mamadou. Abdoul Diop