

ACTIVITY REPORTING FORM
FOR CDC GRANTS PROGRAM
IMU Simons African Fellowship Program

(Deadline for completion: four (4) week after the end of the research visit)

Please note that at least four pictures of the supported activity should be included/ attached to this report. (by email). Please send this report as a pdf-file. After consideration by CDC, the intention is that this activity report and pictures will be made publicly available on the CDC website.

Name of grantee: Dr E.F. Doungmo Goufo

Home institution and country of grantee: University of South Africa.

Name of the host: Dr Dr Bapan Ghosh (main) and Professor A. Ilinca

Name of the host institution and country: Université du Québec à Rimouski, Québec, Canada

Topic of the research activity: Improving signal and image processing via the differentiation with additional parameters and non-singular and/or non-local kernel.

Dates spend at the center/ host institution: 03 April – 03 May 2017 (01 month)

The progress report should a brief (one page) activity report:

The visit was on the topic

Improving signal and image processing via the differentiation with additional parameters and non-singular and/or non-local kernel.

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Details:

Target audience : Electrical and Mechanical Engineers, Applied Mathematicians, Applied Physicians, Numerical Analysts. Masters or doctoral students in one of those fields.

This collaborative visit was just the beginning of a bigger project that aims to explore new directions that recently emerged in Mathematical Modelling, by using three newly introduced notions of differentiation with additional parameters to process and enhance signals and images.

The visit allowed me to meet many other researchers, especially

Dr Bapan Ghosh,

Dept. of Mathematics, Bengal Engg. & Sci.

University, Shibpur, Howrah-711103. India

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who were at a Workshop in Levis Next to Rimouski and representing.

Prof Juan J. Nieto

Departamento de Estadstica, Anlisis Matemtico y Optimizacin,

Univeridad de Santiago de Compostela

15782 Santiago de Compostela, Spain,

And also

Mr Xian Wu

PHD student University of Quebec at Rimouski, Quebec, Canada

Many individual presentations were done with researchers, especially my host's students in Electrical and Mechanical Engineering who previously did not know anything about differentiation with additional parameters, namely New Riemann-Liouville derivative (NRLD)), the Goufo- Caputo derivative with two parameters (2-GCD) and the Goufo- Riemann-Liouville derivative with two parameters (2-GRLD)). The 2-GCD and 2-GRLD are also published as the "Goufo orientators" and all seem to have applications in signal / image processing.

Since the period of the visit was really limited (one month), we focused on the New Riemann-Liouville derivative (NRLD) only.

Hence, the global aim has been to explore numerical methods and signal / image processing with the NRLD.

A global presentation was done by me (see the pictures). During the talk, I performed a full review about the basic theory behind the newly introduced notions of differentiation with additional parameters and related concepts (their Laplace transform formula, their anti-derivatives). I also presented some of their applications together with related open problems (like the development of their numerical definitions which is still outstanding).

It was explained how the differentiations with additional parameters can be applied to real life problems like for instance to improving signal and image processing.

Output

1. The following paper was completed and is about to be submitted:

Attractors for fractional differential problems of transition to turbulent signals

Authors: Emile F. Doungmo Goufo, Juan J. Nieto and Bapan Ghosh

The Acknowledgments section reads as:

The work of E.F. Doungmo Goufo was partially supported by the grant No: 105932 from the National Research Foundation (NRF) and a grant from the Simons Foundation.

2. Another paper is in preparation in collaboration with Mr Xian Wu and Mr Joseph Bolujo. The later being my PhD student working on this project.

The Acknowledgments section will also reads as:

The work of E.F. Doungmo Goufo was partially supported by the grant No: 105932 from the National Research Foundation (NRF) and a grant from the Simons Foundation.

Other visits are planned for a near future in order to use and exploit other derivatives with additional parameters and non-singular and/or non-local kernel

Date: 07 June 2017

Signature Grantee:

