MaSS
DST-NRF CENTRE OF EXCELLENCE IN MATHEMATICAL & STATISTICAL SCIENCES

CoE-MaSS weekly seminar series

THE DST-NRF CENTRE OF EXCELLENCE IN MATHEMATICAL AND STATISTICAL SCIENCES (COE-MASS) AND THE SOUTH AFRICAN SYMPOSIUM OF NUMERICAL AND APPLIED MATHEMATICS (SANUM) IS PROUD TO PRESENT A SEMINAR BY

Prof Luca Gerardo-Giorda

(Centre for Applied Mathematics, Bilbao, Basque Country, Spain)

"Patient-specific numerical simulation of Cortical Spreading Depression"

Friday, 31 March 2017
12h30-13h30

Broadcast live from:
Videoconferencing Facility, 1st Floor
Mathematical Sciences Building, Wits West Campus

How to connect to this seminar remotely:
You can connect remotely via Vidyo to this research seminar by clicking on this link:
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You must please join in the virtual venue (called *"CoE Seminar Room (Wits)"* on Vidyo) strictly between **10h00-10h15**. No latecomers will be added.

Important videoconferencing netiquette:
Once the seminar commences, please mute your own microphone so that there is no feedback from your side into the virtual room. During the Q&A slot you can then unmute your microphone if you have a question to ask the speaker.

Title:
Patient-specific numerical simulation of Cortical Spreading Depression

Presenter:
Prof Luca Gerardo-Giorda; Centre for Applied Mathematics, Bilbao, Basque Country, Spain; lgerardo@bcamath.org

Abstract:
Migraine is a prevailing disease in present day population. Cortical spreading depression (CSD) - a depolarisation wave that originates in the visual region and propagates across the cortex to the peripheral areas - has been suggested, by several studies, as a correlate of visual aura, a neurological phenomenon preceding migraine and causing perceptual disturbance. As of today, little is known about the mechanisms that can trigger or stop such phenomenon. However, the complex and highly individual characteristics of the brain cortex suggest that the geometry might have a significant impact in supporting or contrasting the propagation of CSD. Accurate patient-specific computational models are thus fundamental to cope with the high variability in cortical geometries among individuals, but also with the anisotropies induced in a given cortex by the complex neuronal organisation in the grey matter.

The most accepted assumption to explain CSD propagation is that of a progressive wave of extracellular potassium, which is presumed to follow ordinary diffusion law. Following this assumption, we present a distributed model for the extracellular potassium propagation, coupled with patient-specific conductivity tensors derived locally from Diffusion Tensor Imaging (DTI) data. We also discuss our simulation results highlighting significant differences in the propagation traveling patterns of CSD, both intra and inter-hemispherically.

This is a joint work with JM Kroos and I. Marinelli from BCAM (Bilbao), JM Cortes and I. Diez from BioCruces Health Research Institute (Bilbao) and S. Stramaglia from University of Bari.

Biography
Prof Gerardo-Giorda has a background in Numerical Analysis and Scientific Computing. He worked on Domain Decomposition methods for heterogeneous advection-diffusion problems, and for the Maxwell's equations. In the last 5 years he focused on modeling and numerical simulation of complex systems originating from a wide range of biomedical problems in medicine (heart electrophysiology and more generally the cardiovascular system), biology (diffusion processes in structured populations), and epidemiology (data assimilation and the impact of landscape heterogeneities on the spread of a disease among wildlife).