North-East and Midlands Stochastic Analysis Seminar

Organisers: Z. Brzeźniak (York), H. Boedihardjo, K. D. Elworthy and R. Tribe (Warwick), C. Feng and H.Z. Zhao (Durham), Z. Qian (Oxford)

Tue 6th June 2023 to Wed 7th June 2023

All talks in room MS.04 in Zeeman Building, University of Warwick

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Tuesday 6 June

13:00-14:30 Lunch at Warwick Arts Centre, meet in Mathematics Common Room at 13:00.

14:30-15:20 **Helena Kremp (TU Vienna)**
Weak solution concepts for singular Lévy SDEs in the rough regime

15:20-15:50 Tea Break

15:50-16:20 **Sima Mehri (Warwick)**
Poly-Exp Bounds in Tandem Queues

16:30-17:20 **Anton Thalmaier (University of Luxembourg)**
Calderón-Zygmund inequalities on manifolds by Stochastic Analysis

17:20 Pre-dinner drinks

Evening Dinner

Wednesday 7 June

9:40-10:30 **Karen Habermann (Warwick)**
Stochastic processes on hypersurfaces in contact sub-Riemannian manifolds

10:30-11:00 Tea Break

11:00-11:50 **Mohammud Foondun (Strathclyde)**
Almost sure blow up of stochastic partial differential equations

12:00-12:50 **Lorenzo Zambotti (Sorbonne Université, LPSM)**
TBA

12:50-13:40 Lunch

13:40-14:30 **Feng-Yu Wang (Swansea, Tianjin)**
Wasserstein convergence of empirical measures for non-symmetric Markov processes

14:40-15:30 **Massimiliano Gubinelli (Oxford)**
The stochastic quantisation of the fractional \Phi^4_3 model in the full subcritical regime

15:30-16:00 Tea Break

16:00-17:00 Probability Seminar: **Augusto Teixeira (IMPA)**
TBA

17:00 Pre-dinner drinks

Evening Dinner

For more information on speakers and events please visit:
https://warwick.ac.uk/fac/sci/statistics/news/hb_workshop/

Abstract

Helena Kremp: *Weak solution concepts for singular Lévy SDEs in the rough regime*

In this talk we consider SDEs with Besov drifts beyond the Young regime and additive stable noise. We prove existence and uniqueness of solutions to the singular martingale problem, which was already known by our previous paper. Motivated by the equivalence of probabilistic weak solutions and solutions to the martingale problem in the case of bounded, measurable drifts, we then introduce a notion of weak solutions called "rough weak solutions" for singular SDEs. This generalizes "canonical weak solutions", which are wellposed in the Young regime, but which turn out to be non-unique in the rough regime. Using a combination of rough paths techniques and probabilistic methods, we are able to prove equivalence of rough weak solutions and solutions to the martingale problem. In particular, we can show an Itô-formula for rough weak solutions. *This is joint work with Nicolas Perkowski.*

Sima Mehri: *Poly-Exp Bounds in Tandem Queues*

When the arrival processes are Poisson, queueing networks are well-understood in terms of the product-form structure of the number of jobs N_i at the individual queues; much less is known about the waiting time W across the whole network. In turn, for non-Poisson arrivals, little is known about either N_i's or W. This paper considers a tandem network

\[GI/G/1\to \cdot /G/1\to \cdots\to\cdot /G/1\]

with general arrivals and light-tailed service times. The main result is that the tail $\mathbb{P}(W>x)$ has a polynomial-exponential (Poly-Exp) structure by constructing upper bounds of the form

\[(a_Ix^I+\cdots+a_1 x+a_0)e^{-\theta x} \]

The degree I of the polynomial depends on the number of bottleneck queues, their positions in the tandem, and also on the `light-tailedness' of the service times. The bounds hold in non-asymptotic regimes (i.e., for \textit{finite} x), are shown to be sharp, and improve upon alternative results based on large deviations by (many) orders of magnitude. The overall technique is also particularly robust as it immediately extends, for instance, to non-renewal arrivals.

Joint work with Prof. Florin Ciucu

Karen Habermann: *Stochastic processes on hypersurfaces in contact sub-Riemannian manifolds*

We construct and study a canonical stochastic process on a smooth hypersurface embedded in a contact sub-Riemannian manifold. The generator of the stochastic process is defined outside a set of singular points on the hypersurface, and it arises as the limit of Laplace-Beltrami operators built by means of Riemannian approximations to the sub-Riemannian structure using the Reeb vector field. We carefully analyse three families of model cases for our setting obtained by considering canonical hypersurfaces embedded in model spaces for contact sub-Riemannian manifolds. In these model cases, we show that the canonical stochastic process almost surely does not hit singular points.

Mohammud Foondun: *Almost sure blow up of stochastic partial differential equations*

Blow up or non existence of global solutions is an important topic in the theory of partial differential equations. However, for stochastic partial differential equations, blow up problems haven’t received as much attention. In this talk, we will start off by reviewing some classical results for ODEs and PDEs and then describe some more recent results for SPDEs. This is based on joint work with E. Nualart and with E. Nualart and D. Khoshnevisan.

Feng-Yu Wang: *Wasserstein convergence of empirical measures for non-symmetric Markov processes*

In this talk we briefly recall some recent progress on the Wasserstein convergence of empirical measures for symmetric diffusion processes, then introduce some new results for non-symmetric Markov processes,

where the precise acceleration on the Wasserstein convergence is presented for divergence free non-symmetric permutations. The general results are illustrated by concrete examples.

Massimiliano Gubinelli: *The stochastic quantisation of the fractional \Phi^4_3 model in the full subcritical regime.*

Stochastic quantisation is a stochastic analysis adapted to the multidimensional and distributional fields, in particular those arising in the Euclidean formulation of quantum field theory. In order to see this idea in action I will give a sketch of a novel proof of the existence of the fractional Φ^4 Euclidean quantum field theory on the three dimensional Euclidean space and in the full subcritical regime via parabolic stochastic quantisation. Our approach is based on the use of a truncated flow equation for the effective description of the model at sufficiently small scales and on coercive estimates for the non-linear stochastic partial differential equation describing the interacting field.

Joint work with P. Rinaldi.