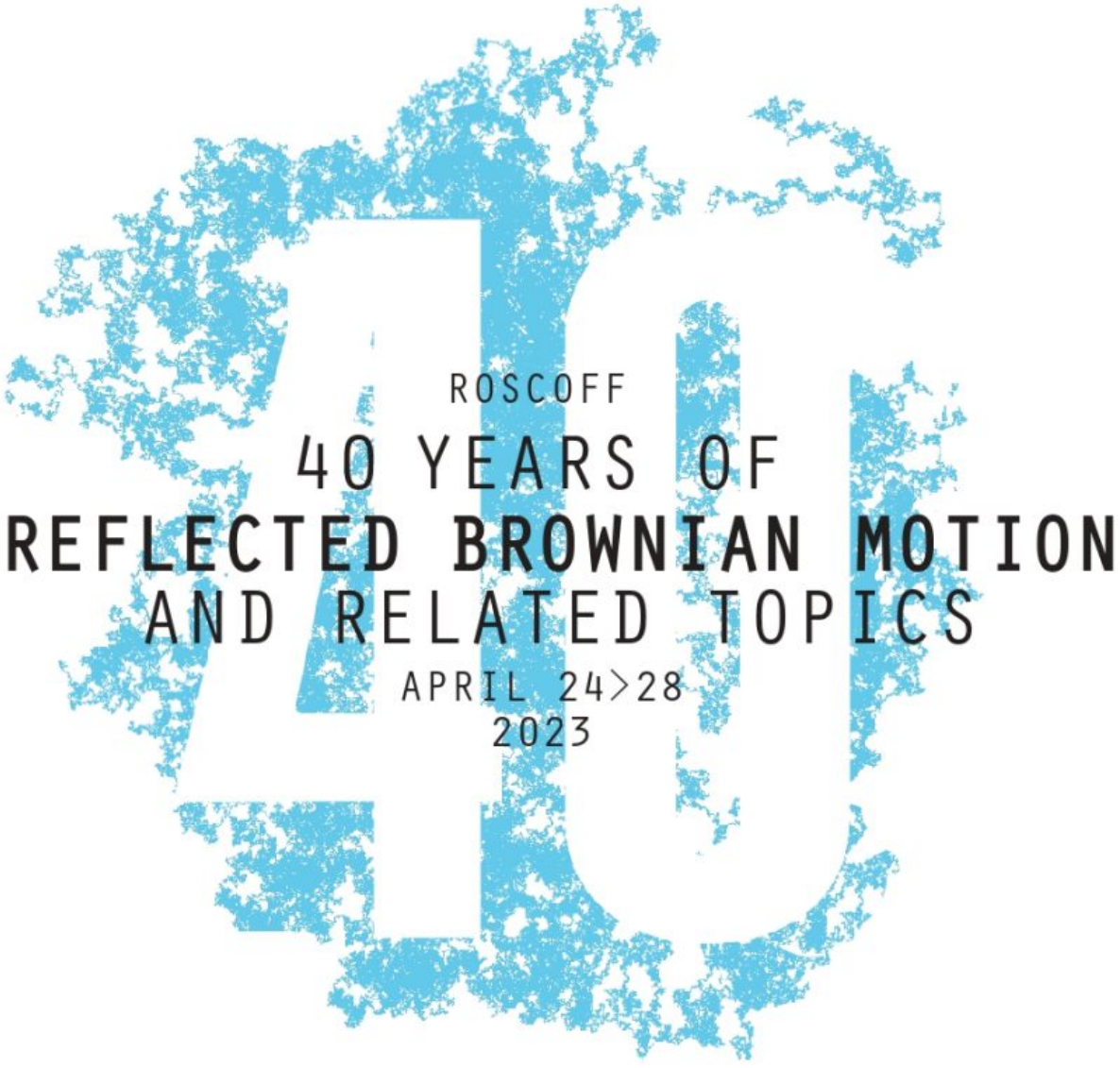
Booklet of the conference



This is the booklet for print use.
Full abstracts with all authors can be found at:
https://40yearsofrbm.wp.imt.fr/

Contents

About

Description

The conference will bring together various researchers working on reflected stochastic processes and their applications in other fields of mathematics. The conference will reflect the diversity of RBM topics: from the historical beginnings of the study of RBM to new developments and applications.

Date and place

The conference take place in April 24-28, 2023 in Brittany in France, in the (small) city of Roscoff, where there is a beautiful CNRS conference center.

Scientific committee

Irina Kurkova Jean-François Le Gall Michel Mandjes Ruth Williams

Organizing committee

Sandro Franceschi Héléne Guerin Kilian Raschel

Invited speakers

Sebastian Andres	Rami Atar	Jose Blanchet	Mireille Bousquet Mélou
Onno Boxma	Maury Bramson	Amarjit Budhiraja	Krzysztof Burdzy
Xinyun Chen	Zhen-Qing Chen	Cristina Costantini	Jim Dai
Krzysztof Debicki	Manon Defosseux	Philip Ernst	Mihai Gradinaru
Mike Harrison	Ioannis Karatzas	David Lipshutz	Michel Mandjes
Sara Mazzonetto	Masakiyo Miyazawa	Amber Puha	Kavita Ramanan
Josh Reed	Martin Reiman	Gregory Schehr	Ruth Williams

Sponsors

This meeting is funded by the Centre Henri Lebesgue, the ANR JCJC grant « RESYST » and the ERC grant « Elliptic Combinatorics ».

Timetable

The conference starts at 9 a.m. every day.

The conference can be followed online at the zoom link.

`https://us02web.zoom.us/j/81950888340?pwd=djZTQzBXQ2FZQm1EaGhjR2xYTldYUT09`

Monday, April 24		**Tuesday, April 25**		**Wednesday, April 26**		**Thursday, April 27**		**Friday, April 28**	
9h-9h20	**Welcome coffee**			**Chairmans**	Ata/Mijatovic				
9h20-9h30	Intro organizers	**Chairman**	Fayolle	9h-9h20	Estevez	**Chairman**	Lakner	**Chairman**	Ichiba
Chairman	Kella	9h-9h40	BousquetMélou	9h20-9h40	Bresar	9h-9h30	Miyazawa	9h-9h40	Mandjes
9h30-10h10	Harrison	9h40-10h20	Boxma	9h40-10h00	Nessmann	9h30-10h10	Costantini	9h40-10h20	Mazzonetto
10h10-10h50	Atar	10h20-10h40	**Coffee break**	10h00-10h20	**Coffee break**	10h10-10h40	**Coffee break**	10h20-10h40	**Coffee break**
10h50-11h10	**Coffee break**	10h40-11h20	X. Chen	10h20-10h40	Housley	10h40-11h20	Ernst	10h40-11h20	Reed
11h10-11h50	Andres	11h20-12h	Schehr	10h40-11h00	Zhang	11h20-12h	Z-Q Chen	11h20-12h	Karatzas
11h50-12h30	Burdzy			11h00-11h20	Sauzedde				
				11h20-11h30	**Coffee break**				
13h	**Lunch**	12h30	**Lunch**	11h30-11h50	Guang	12h30	**Lunch**	12h15	**Lunch**
				11h50-12h10	Jacobovic				
				12h10-12h30	Hérent				
Chairman	Hasenbein	**Chairman**	Kelly	13h	**Lunch**	**Chairman**	Chapon		
15h-15h40	Budhiraja	15h-15h40	Dai			15h-15h40	Puha		
15h40-16h20	Debicki	15h40-16h20	Ramanan			15h40-16h20	Lipshutz		
16h20-16h40	**Coffee break**	16h20-16h40	**Coffee break**	14h30	**Excursion**	16h20-16h40	**Coffee break**		**End**
16h40-17h20	Harrison-Williams	16h40-17h10	Blanchet			16h40-17h20	Gradinaru		
17h20-17h50	Williams	17h15-17h45	Bramson			17h20-17h40	Dianetti		
		17h50-18h20	Reiman			17h40-17h50	**Coffee break**		
				18h30	**Poster session**	17h50-18h10	Arista		
						18h10-18h30	Fitzgerald		
19h30	**Dinner**	19h30	**Conf Dinner**	19h30	**Dinner**	19h30	**Dinner**		

IS Invited Speaker RT Remote talk PD PhD or Postdoc.

Monday, April 24

9:00–9:20	**Welcome coffee**		
9:20–9:30	**Introduction of the organizers**		
Chairman	**Offer Kella**		
9:30–10:10	IS	**Mike Harrison** Stanford University	Drift control of high-dimensional RBM: A computational method based on neural networks
10:10–10:50	IS	**Rami Atar** Technion	A Skorohod problem for the heat equation and particle systems with selection
10:50–11:10	**Coffee**		
11:10–11:50	IS	**Sebastian Andres** University of Manchester	RBM meets RCM
11:50–12:30	IS	**Krzysztof Burdzy** University of Washington	On the spine of Fleming-Viot process
13:00	**Lunch**		
Chairman	**John Hasenbein**		
15:00–15:40	IS	**Amarjit Budhiraja** University of North Carolina at Chapel Hill	Invariant Measures of the Infinite Atlas Model: Domains of Attraction, Extremality, and Equilibrium Fluctuations
15:40–16:20	IS	**Krzysztof Debicki** Mathematical Institute, University of Wroclaw	Extremes of reflected Gaussian processes
12:20–16:40	**Coffee**		
16:40-17:20	IS	**Harrison-Williams** Stanford University and University of California	RBM and Queueing Theory: An Early History
17:20-17:50	RT	**Ruth Williams** University of California, San Diego	Biochemical reaction networks and reflecting diffusion processes
19:30	**Dinner**		

Tuesday, April 25

Chairman	**Guy Fayolle**		
9:00–9:40	IS	**Mireille Bousquet Mélou** CNRS, LaBRI, Université de Bordeaux	On the stationary distribution of reflected Brownian motion in a wedge
9:40–10:20	IS	**Onno Boxma** Eindhoven University of Technology	Workload analysis of a two-queue fluid polling model
10:20–10:40	**Coffee**		
10:40–11:20	IS	**Xinyun Chen** Chinese University of Hong Kong, Shenzhen	Asymptotic product-form stationary distributions for reflected Brownian motions
11:20–12:00	IS	**Gregory Schehr** CNRS-Sorbonne Université	Universal order statistics for random walks
12:30	**Lunch**		
Chairman	**Frank Kelly**		
15:00–15:40	IS	**Jim Dai** Cornell University and CUHK-Shenzhen	Asymptotic steady-state independence for generalized Jackson networks in multi-scale heavy traffic
15:40–16:20	IS	**Kavita Ramanan** Brown University	Pathwise differentiability of reflected diffusions
12:20–16:40	**Coffee**		
16:40-17:10	RT	**Jose Blanchet** Stanford	Asymptotic Control of Centralized Dynamic Matching Markets with General Utilities
17:15-17:45	RT	**Maury Bramson** University of Minnesota	Positive Recurrent Semimartingale Reflecting Brownian Motion with Divergent Fluid Paths
17:50-18:20	RT	**Martin Reiman** Columbia University	Parallel Server Systems under an Extended Heavy Traffic Condition
19:30	**Conference Dinner**		

Wednesday, April 26

Chairmans	Baris Ata and Aleks Mijatovic		
9:00–9:20	PD	**Ben Estevez** University of North Carolina at Chapel Hill	Load Balancing in Parallel Queues and Rank-based Diffusions
9:20–9:40	PD	**Miha Bresar** University of Warwick	Brownian motion with asymptotically normal reflection in unbounded domains: from transience to stability
9:40–10:00	PD	**Andreas Nessmann** Technische Universität Wien, Université de Tours	Asymptotics of Random Walks in the Quarter Plane
10:00–10:20	**Coffee**		
10:20–10:40	PD	**Benjamin Housley** University of Manchester	Extended Lévy's Theorem for a Two-Sided Reflection
10:40–11:00	PD	**Zhiqiang Zhang** The University of Chicago Booth School of Business	Routing in a Queueing Loss Model under Imperfect Classifications
11:00–11:20	PD	**Isao Sauzedde** University of Warwick	CLT for reflecting Brownian motion in generalized parabolic domains
11:20–11:30	**Coffee**		
11:30–11:50	PD	**Jin Guang** The Chinese University of Hong Kong, Shenzhen	Uniform Moment Bounds for Generalized Jackson Networks in Multi-scale Heavy Traffic
11:50–12:10	PD	**Royi Jacobovic** University of Amsterdam	The moments of polynomial functionals in Levy-driven queues
12:10–12:30	PD	**Charlie Hérent** Université Paris Cité / Université Gustave Eiffel	An inverse Pitman's theorem for a space-time brownian motion in a type A_1^1 Weyl chamber
13:00	**Lunch**		
14:30	**Excursion to Ile de Batz**		
18:30	**Poster session at the Gulf Stream Hôtel**		
	Miha Bresar, Khalifa Es-Sebaiy, Jules Flin,		
	Jin Guang, Maxence Petit, Zhiqiang Zhang		
19:30	**Dinner**		

Thursday, April 27

Chairman	Peter Lakner		
9:00–9:30	RT	**Masakiyo Miyazawa** Tokyo University of Science	Palm problems arising in BAR approach
9:30–10:10	IS	**Cristina Costantini** Università di Chieti-Pescara	Obliquely reflecting diffusions in curved, nonsmooth domains
10:10–11:40	**Coffee**		
10:40–11:20	IS	**Philip Ernst** Imperial College London	On the diameter of the stopped spider process
11:20–12:00	IS	**Zhen-Qing Chen** University of Washington	Approximation of Liouville Brownian motion
12:30	**Lunch**		
Chairman	**François Chapon**		
15:00–15:40	IS	**Amber Puha** California State University San Marcos	Diffusion Limits for Multiclass Processor Sharing Queues
15:40–16:20	IS	**David Lipshutz** Flatiron Institute	Sensitivity analysis of obliquely reflected diffusions in convex polyhedral domains
12:20–16:40	**Coffee**		
16:40-17:20	IS	**Mihai Gradinaru** IRMAR	Lévy driven non-linear Langevin type equations
17:20-17:40	PD	**Jodi Dianetti** Center for Mathematical Economics, Bielefeld University	Multidimensional singular control and related Skorokhod problem: sufficient conditions for the characterization of optimal controls
17:40–17:50	**Coffee**		
17:50-18:10	PD	**Jonas Arista** Bielefeld University	Matsumoto-Yor and Dufresne type theorems for a random walk on positive definite matrices
18:10-18:30	PD	**Will FitzGerald** University of Manchester	Reflected Brownian motions and random growth models
19:30	**Dinner**		

Friday, April 28

Chairman	Tomoyuki Ichiba		
9:00–9:40	IS	**Michel Mandjes** Univ. of Amsterdam	Lévy driven queues: the workload correlation function is positive, decreasing and convex
9:40–10:20	IS	**Sara Mazzonetto** Université de Lorraine	Parameter estimation for skew/sticky BM
10:20–10:40	**Coffee**		
10:40–11:20	IS	**Josh Reed** NYU Stern	RBM with Drift in a Wedge
11:20–12:00	IS	**Ioannis Karatzas** Columbia University	Competing diffusive particle systems and models of large equity markets
12:15	**Lunch**		
	End		

List of Abstracts – Talks

Monday, April 24

Drift control of high-dimensional RBM: A computational method based on neural networks

Mike Harrison Stanford University

IS

We consider a stochastic control problem whose state space is the d-dimensional non-negative orthant. The controlled process Z evolves as a reflected Brownian motion whose covariance matrix is exogenously specified, as are its directions of reflection from the orthant's boundary surfaces. A controlling agent chooses a drift vector at each time t based on the history of Z, and the cost rate at time t depends on both Z(t) and the drift rate chosen. In our initial problem formulation, the objective is to minimize expected discounted cost over an infinite planning horizon, after which we treat the corresponding ergodic control problem. Extending earlier work by Han et al. (Proceedings of the National Academy of Sciences, 2018, 8505-8510), we develop and illustrate a simulation-based computational method that relies heavily on deep neural network technology. Our method is accurate to within a fraction of one percent, and is computationally feasible in dimensions up to at least d=20. (Based on joint work with Baris Ata and Nian Si.)

A Skorohod problem for the heat equation and particle systems with selection

Rami Atar Technion

IS

Hydrodynamic limits of particle systems with selection are related to free boundary problems (FBP) associated with second order parabolic PDE. This relation has been established rigorously for some selection models while it remains open for others, where the difficulty lies in questions of regularity of the free boundary. We introduce a weak formulation of FBP in the form of a Skorohod problem for the PDE. It does not involve a free boundary at all, but at the same time reduces to a FBP provided the latter has a classical solution. The weak formulation allows us to avoid regularity questions and characterize limits in terms of the PDE in cases where classical solutions are expected to but not known to exist, as well as in cases where they are not expected to exist.

RBM meets RCM

Sebastian Andres University of Manchester

IS

The random conductance model (RCM) is a well-established model for a random walk in random environment which has been object of intensive study in the last 15 years. Central questions of interest include homogenisation results such as functional central limit theorems for the random walk or local limit theorems for its heat kernel. In this talk we will review those results where one main focus will be on invariance principles for RCMs on domains for which convergence towards reflected Brownian motion (RBM) has been established by Chen, Croydon and Kumagai (A0P 2015). In the last part we will present a local limit theorem for the killed Green function on strongly regular domains for ergodic conductances only satisfying a moment condition. As an application we obtain scaling limits for inhomogenous discrete Gaussian free fields with random conductances. The last part is based on a joint work in progress with Martin Slowik (Mannheim) and Anna-Lisa Sokol (Berlin).

On the spine of Fleming-Viot process

Krzysztof Burdzy University of Washington

IS

A Fleming-Viot process is a system of n particles driven by independent copies of a driving Markov process. When one of the particles hits the boundary of the domain, it is killed, and some other particle branches. There is only one infinite path (spine) in the branching structure. Under some assumptions, when n goes to infinity, the distribution of the spine converges to the distribution of the driving Markov process conditioned to avoid the boundary of the domain forever. Based on joint articles with M. Bieniek, J. Englander, and T. Tadic.

Invariant Measures of the Infinite Atlas Model: Domains of Attraction, Extremality, and Equilibrium Fluctuations

Amarjit Budhiraja University of North Carolina at Chapel Hill

IS

The infinite Atlas model describes a countable system of competing Brownian particles where the lowest particle gets a unit upward drift and the rest evolve as standard Brownian motions. The stochastic process of gaps between the particles in this model is described by an infinite dimensional Skorohod problem. This Markov process does not have a unique stationary distribution and in fact there is a one parameter family p(a),a>= 0 of product form mutually singular stationary distributions. We say that an initial distribution of gaps is in the weak domain of attraction of the stationary measure p(a) if the time averaged laws of the stochastic process of the gaps, when initialized using that distribution, converge to p(a) weakly in the large time limit. We provide general sufficient conditions on the initial gap distribution of the Atlas particles for it to lie in the weak domain of attraction of p(a) for each a. Results on extremality and ergodicity of p(a) will also be presented. Finally, we will introduce a SPDE that describes equilibrium fluctuations associated with p(a). This is based on joint works with Sayan Banerjee and Peter Rudzis.

Extremes of reflected Gaussian processes

Krzysztof Debicki Mathematical Institute, University of Wroclaw

IS

We derive exact asymptotics of the tail distribution of extreme-type functionals of reflected (at 0) Gaussian processes with stationary increments. Then, we turn to the multidimensional case for which we analyse asymptotic properties of the probability of hitting the upper orthant.

RBM and Queueing Theory: An Early History

Mike Harrison[1] ***Ruth Williams***[2] [1] Stanford University [2] University of California

IS

In this talk we will recap the development of RBM as a limit of, or approximation for, conventional discrete-flow queueing models. Emphasis will be on the speakers' personal experiences and personal involvement in the field between 1960 and 2000.

Biochemical reaction networks and reflecting diffusion processes

Ruth Williams University of California, San Diego

RT

In 2019, Leite and Williams proposed certain reflected diffusion processes as approximations to continuous time Markov chain models frequently used to model biochemical reaction networks. These diffusions live in the positive orthant of a d-dimensional space and are confined there by a smoothly varying oblique reflection field on the boundary. Leite and Williams showed that, under mild conditions, these diffusions can be obtained as weak limits of certain jump-diffusion extensions of the traditional Langevin approximations, and therefore called these constrained Langevin approximations. In this talk, we will review this approximation and describe some progress on proving error estimates for strong versions of this approximation and also describe some remaining open problems. Part of this work is joint with Felipe Campos.

Tuesday, April 25

On the stationary distribution of reflected Brownian motion in a wedge

Mireille Bousquet Mélou CNRS, LaBRI, Université de Bordeaux

IS

We consider the classical problem of determining the stationary distribution of the semimartingale reflected Brownian motion (SRBM) in a two-dimensional wedge. We focus on the algebraic and differential nature of the Laplace transform of this stationary distribution. We derive necessary and sufficient conditions for this Laplace transform to be a rational, algebraic, differentially finite or more generally differentially algebraic function (meaning that it satisfies a polynomial differential equation). These conditions are simple explicit linear dependencies between the angles of the model. We thus recover in particular the Dieker and Moriarty conditions for rationality. In the D-algebraic case, we obtain moreover simple, explicit integral-free expression in terms of a hypergeometric function. To prove these results, we start from a functional equation that the Laplace transform satisfies, to which we apply a variety of tools ranging from combinatorics to Galois theory.

This is a joint work with Andrew Elvey Price, Sandro Franceschi, Charlotte Hardouin and Kilian Raschel.

Workload analysis of a two-queue fluid polling model

Onno Boxma Eindhoven University of Technology

IS

We analyze a two-queue random time-limited Markov modulated polling model. Fluid arrives at the two queues as two independent flows with deterministic rates. A single server serves both queues at constant speeds, alternatingly spending an exponentially distributed amount of time in each queue and experiencing no switchover time. We derive a functional equation for the Laplace-Stieltjes transform of the stationary joint fluid content (workload) distribution, that leads to a Riemann-Hilbert boundary value problem (BVP). After taking a heavy-traffic limit, and restricting ourselves to the symmetric case, the boundary value problem simplifies and can be solved explicitly. Next, allowing for more general (Levy) input processes and server switching policies, we investigate the transient process-limit of the joint workload in heavy traffic, exploiting the RBM theory. Again solving a BVP, we determine the stationary distribution of the limiting process. We show that, in the symmetric case, this distribution coincides with our earlier BVP solution, implying that in this case the two limits (stationarity and heavy traffic) commute.

Joint work with Stella Kapodistria, Offer Kella and Mayank Saxena.

Asymptotic product-form stationary distributions for reflected Brownian motions

Xinyun Chen Chinese University of Hong Kong, Shenzhen

IS

We prove that a sequence of multi-scaled stationary distributions of reflected Brownian motions (RBMs) has a product-form limit. Each component in the limit is an exponential distribution. The multi-scaling corresponds to the « multi-scale heavy traffic » recently advanced in Dai, Glynn and Xu (2023) for generalized Jackson networks. The proof utilizes the basic adjoint relationship (BAR) first introduced in Harrison and Williams (1987) that characterizes the stationary distribution of an RBM. This is a joint work with Jin Guang at CUHK-Shenzhen, Jim Dai at Cornell, and Peter Glynn at Stanford.

Universal order statistics for random walks

Gregory Schehr CNRS-Sorbonne Université

IS

I will study the statistics of the gaps $\Delta_{k,n}$ between the k^{th} and $(k+1)^{th}$ maximum of the set of positions $\{x_1, \ldots, x_n\}$ of a random walk after n steps, starting from the origin. I will discuss the case of continuous jump distributions $f(\eta)$, with a corresponding Lévy index $0 < \mu \leq 2$. I will show that one can obtain an exact analytical expression for the probability distribution $P_{k,n}(\Delta)$ valid for any k and n, and jump distribution $f(\eta)$, which is amenable to an asymptotic large n analysis. In this limit, one finds that the gap distribution becomes stationary, i.e., $\lim_{n\to\infty} P_{k,n}(\Delta) = P_k(\Delta)$. Furthermore, for $\mu > 1$, I will show that in the limit of $k \to \infty$ the stationary distribution exhibits a universal scaling form $P_k(\Delta) \sim k^{1-1/\mu}\mathcal{P}_\mu(k^{1-1/\mu}\Delta)$ which depends only on the Lévy index μ, but not on the details of the jump distribution. This limiting scaling function $\mathcal{P}_\mu(x)$ can be computed explicitly in terms of Mittag-Leffler functions.

Asymptotic steady-state independence for generalized Jackson networks in multi-scale heavy traffic

Jim Dai Cornell University and CUHK-Shenzhen

IS

We prove that under a multi-scale heavy traffic condition, the stationary distribution of the scaled queue length process in any generalized Jackson network has a product-form limit. Each component in the product-form has an exponential distribution, corresponding to the Brownian approximation of a single station queue. Each "single station" can be constructed precisely and its parameters have a good intuitive interpretation. The proof employs a basic adjoint relationship (BAR)-approach that has been advanced recently by Braverman, Dai, and Miyazawa (2017, 2023). This is a joint work with Peter Glynn at Stanford and Yaosheng Xu at Amazon.

Pathwise differentiability of reflected diffusions

Kavita Ramanan Brown University

IS

Differentiability of flows and sensitivity analysis are classical topics in dynamical systems. In the stochastic context, stochastic flows have been well studied by Kunita and others. However, the analysis of these properties for constrained or reflected processes, which arise in a variety of applications, is challenging due to the discontinuous dynamics at the boundary of the domain, and is further complicated when the boundary is non-smooth. We show that the study of both differentiability of flows and sensitivities of constrained processes in convex polyhedral domains can be largely reduced to the study of directional derivatives of an associated map, called the Skorokhod map, and we introduce an axiomatic framework to characterize these directional derivatives. In addition, we establish pathwise differentiability of a large class of reflected diffusions in convex polyhedral domains and show that they can be described in terms of certain constrained stochastic differential equations with time-varying domains and directions of reflection. This is based on joint works with David Lipshutz.

Asymptotic Control of Centralized Dynamic Matching Markets with General Utilities

Jose Blanchet Stanford

RT

We consider a matching market where buyers and sellers arrive according to Poisson processes. Participants abandon at a constant rate — independent of the arrivals. The utility for matching a given buyer with a seller is a general random variable. The utilities are i.i.d. and independent of arrivals and abandonment. We study this market in heavy-traffic and analyze two families of policies: a) the population threshold policy, matching an arriving agent to its best available mate only if the number of mates in the system is above a threshold, and b) the utility threshold policy, matching an arriving agent to its best available mate only if the corresponding utility is above a threshold. We obtain a Skorokhod problem which we use to characterize optimal (utility maximization) population threshold policies depending on the domain of attraction corresponding to the utilities. Analogous characterizations for optimal utility-based threshold policies are also discussed. This talk is based on joint work with Martin I. Reiman, Virag Shah, Lawrence M. Wein, Linjia Wu.

Positive Recurrent Semimartingale Reflecting Brownian Motion with Divergent Fluid Paths

Maury Bramson University of Minnesota

RT

Fluid paths correspond to the paths of a semimartingale reflecting Brownian motion (SRBM), but with the randomness removed. Their behavior is therefore often easier to analyze than that of the corresponding SRBM. In Dupuis and Williams (1994), it was showed that, in any dimension d, if every fluid path is attracted to the origin, then the corresponding SRBM must be positive recurrent.

It remained unknown whether the converse direction always holds. In d=2, the proof that the converse holds is relatively straightforward, but the proof in d=3 is more complex. A similar approach in d=4 already becomes unmanageable because of the many possible cases that need to be analyzed.

In Bramson (2011), examples were given, in d>5, with divergent fluid paths whose corresponding SRBM are positive recurrent. In these examples, the covariance matrix for the SRBM is the identity matrix I. The existence of examples in d=4 and d=5 was left open. Heyda has recently produced examples in d=4 and d=5 with divergent fluid paths whose corresponding SRBM are positive recurrent. For the examples in d=5, the covariance matrix is I; for the examples in d=4, a different covariance matrix is needed.

In this talk, we will summarize the above results in d>5, and how related techniques can be applied in d=4 and d=5.

Parallel Server Systems under an Extended Heavy Traffic Condition

Martin Reiman Columbia University

RT

Parallel server systems (PSS) are queueing control problems with a relatively simple structure. There are I classes of customers and K servers, and the service rate depends on the class-server pair. The controls involve both deciding which server serves each customer, as well as the order in which they are served. The objective is to minimize the expected infinite horizon total discounted cost, where the cost rate is a linear function of the queue length vector. A linear program (LP) known as the static allocation problem was introduced in order to define heavy traffic for these systems. Previous work on PSS made the key assumption that the static allocation LP has a unique solution. We relax this assumption, introducing the extended heavy traffic condition, which allows multiple solutions. The existence of multiple solutions to the LP introduces complications in the treatment of this problem. In particular, there is now freedom to choose among the LP solutions, which determine the fluid scale allocation of effort by the servers. This non-deterministic fluid limit leads to technical problems along with a more complicated limiting workload control problem (WCP). Under the additional assumption of complete resource pooling, we provide an asymptotic lower bound on the achievable cost in terms of the solution of the WCP. In addition, for the simple special case of I=K=2, where the WCP is solvable, we translate the optimal control into a control policy for the original PSS and prove that it is asymptotically optimal. (Based on joint work with Rami Atar and Eyal Castiel.)

Wednesday, April 26

Load Balancing in Parallel Queues and Rank-based Diffusions

Ben Estevez University of North Carolina at Chapel Hill

PD

We analyze heavy traffic limits and stationary distributions of rank-based routing policies where incoming jobs are routed to servers with probability depending on their ranked queue-lengths. The limiting reflected diffusions are connected to the gaps between particles in rank-based diffusions like the Atlas model. We discuss in particular the special case where a small fraction of the incoming jobs is channeled to the shortest queue and the rest are uniformly routed, which we call the marginal join-the-shortest-queue (MJSQ) policy, and compare this to well-known load balancing schemes. This policy significantly reduces overhead communication costs compared to the asymptotically optimal join-the-shortest-queue policy, but we have shown that it nevertheless achieves comparable performance. Even when the whole system is unstable, we have shown that the gap between the maximum and minimum queue length under MJSQ is tight, exhibiting a novel form of load balancing. The stationary distributions of the limiting diffusion processes (for the general rank-based routing policies) are identified as product laws of Exponential random variables. The associated statistics of the pre-limiting process have been shown to converge to those of the limiting diffusion as the heavy traffic parameter goes to infinity.

Joint work with Sayan Banerjee and Amarjit Budhiraja.

Brownian motion with asymptotically normal reflection in unbounded domains: from transience to stability

Miha Bresar University of Warwick **PD**

We quantify the asymptotic behaviour of multidimensional drifltess diffusions in domains unbounded in a single direction, with asymptotically normal reflections from the boundary. We identify the critical growth/contraction rates of the domain that separate stabil- ity, null recurrence and transience. In the stable case we prove existence and uniqueness of the invariant distribution and establish the polynomial rate of decay of its tail. We also establish matching polynomial upper and lower bounds on the rate of convergence to stationarity in total variation. All exponents are explicit in the model parameters that determine the asymptotics of the growth rate of the domain, the interior covariance, and the reflection vector field. Proofs are probabilistic, and use upper and lower tail bounds for additive functionals up to return times to compact sets, for which we develop novel sub/supermartingale criteria, applic- able to general continuous semimartingales. Narrowing domains fall outside of the standard literature, in part because boundary local time can accumulate arbitrarily rapidly. Establishing Feller continuity (essential for characterizing stability) thus requires an extension of the usual approach. Our recurrence/transience classification extends previous work on strictly normal reflections, and expands the range of phenomena observed across all dimensions. For all recurrent cases, we provide quantitative information through upper and lower bounds on tails of return times to compact sets.

(Based on joint work with Aleks Mijatovic and Andrew Wade)

Asymptotics of Random Walks in the Quarter Plane

Andreas Nessmann Technische Universität Wien, Université de Tours **PD**

The main question posed in this presentation will be about the behaviour of the number of lattice paths starting from a fixed point and ending at (possibly another) fixed point, where we let the number of steps go to infinity. As the scaling limit of a random walk is a Brownian motion, it is not all that surprising that these asymptotics closely resemble those of the equivalent continuous problem; something that has been shown for the first order terms in 2011 by Denisov and Wachtel. In this presentation it will be shown that for finite, orbit-summable models a generalisation of their result holds, which allows us to write an asymptotic expansion as a series of polyharmonic functions with polynomial weights.

Extended Lévy's Theorem for a Two-Sided Reflection

Benjamin Housley University of Manchester **PD**

We aim to set forth an extension of the result found in paper [2], which finds an explicit realisation of a reflecting Brownian motion with drift $-\mu$, started at x , reflecting above zero, and its local time at zero. In this paper we find a corresponding realisation for a reflecting Brownian motion with drift $-\mu$, started at x, reflected both above zero and below one, along with a corresponding expression in terms of associated local times, namely as the difference between the local time at zero and the local time at one.

Routing in a Queueing Loss Model under Imperfect Classifications

Zhiqiang Zhang The University of Chicago Booth School of Business PD

Motivated by reducing the recidivism (reoffense) rate in criminal justice we study a multiclass loss model (multiclass G/M/s/s+M) to help determine admission decisions to incarceration diversion programs that have limited capacities, which serves as an alternative to incarceration and could lower the likelihood of recidivism but cannot prevent reoffense while in the program. Service time in the model corresponds to time in the diversion program, and reneging corresponds to an offense being committed while in service. A (potentially imperfect) classification algorithm predicts which individuals may benefit the most from the programs and which individuals have the most risk to recidivate. The admission decisions aim to minimize the long-run average total cost, which consists of recidivism cost, diversion program cost, and incarceration cost. The major trade-off is to whether admit the current arriving individual or reserve the spot for upcoming individuals who could potentially benefit more. We first formulate a fluid control problem and show that the solution to that fluid control problem motivates using a simple prioritization scheme to determine admission decisions, assuming either no prediction error or existence of a stochastic ordering property. Next, moving to diffusion control, under a heavy-traffic regime, we approximate the system state (program population for different classes) by a multi-dimensional reflected Brownian motion in a rectangle with lower left-hand corner at the origin, and dimension equal to the number of classes. For a single class setting, the one-dimensional diffusion problem can be analytically solved. However, for the multiclass setting, the multidimensional diffusion control problem is analytically very challenging, and we are investigating potential decomposition heuristics leveraging the priority schedule from the fluid control to solve approximately.

CLT for reflecting Brownian motion in generalized parabolic domains

Isao Sauzedde University of Warwick PD

We consider an obliquely reflected Brownian motion in a 1+d dimensional domain given by the points (x, y) such that $|y|_d$ is smaller than a function which asymptotically grows as a (possibly negative) power of x. Depending on that power and on the reflection field, the resulting process has a different behaviour at the first order: the x component can either explode in finite time, or be diffusive, or diverge toward infinity as any power of t greater than a half. In this last intermediate case, we will explain this first order behaviour as well as the central limit theorem that comes after.

This talk is based on a joint work with A. Mijatović and A. Wade.

Uniform Moment Bounds for Generalized Jackson Networks in Multi-scale Heavy Traffic

Jin Guang The Chinese University of Hong Kong, Shenzhen PD

We establish uniform moment bounds for steady-state queue lengths of generalized Jackson networks (GJN) in multi-scale heavy traffic as recently proposed by Dai et al. [2022]. Uniform moment bounds lay the foundation for further analysis of the limit stationary distribution. Our result can be used to verify the crucial moment state space collapse (SCC) assumption in Dai et al. [2022] to establish a product-form limit of GJN in the multi-scale heavy traffic regime. Our proof utilizes a novel basic adjoint relationship (BAR) approach to characterize the stationary distribution directly.

The moments of polynomial functionals in Levy-driven queues

Royi Jacobovic University of Amsterdam

PD

Consider the problem of computing the moments of the area beneath the workload process of a stable M/G/1 queue during a busy period. This problem was introduced by Iglehart (1971) who solved the first moment. Later, Cohen (1978) solved the second moment and there are no existing results about higher moments. In this work, we solve this long-standing problem in the setup of a Levy-driven queue. Specifically, the main result of the current work is a new recursive formulae which yield all moments (including joint ones) of polynomial functionals of the workload process. This is a joint work with Peter Glynn and Michel Mandjes.

An inverse Pitman's theorem for a space-time brownian motion in a type A_1^1 Weyl chamber

Charlie Hérent Université Paris Cité / Université Gustave Eiffel

PD

We present an inverse Pitman's theorem for a space-time Brownian motion conditioned in Doob's sense to remain in an affine Weyl chamber. Our theorem provides a way to recover an unconditioned spacetime Brownian motion from a conditioned one applying a sequence of path transformations.

Thursday, April 27

Palm problems arising in BAR approach

Masakiyo Miyazawa Tokyo University of Science

RT

We consider a Markov process with time homogeneous transitions which is jointly stationary with multiple point processes. Assuming that these point processes have finite intensities, we define Palm distributions concerning them. Motivated by a BAR (Basic adjoint relationship) approach, which extensively uses the Palm distributions, we are interested in two problems; (a) when this stationary Markov process inherits the same Markov structure under the Palm distributions, and (b) how the state changes at counting instants of the point processes can be handled to derive stationary equations when there are simultaneous counts and each of them influences the state changes. We call (a) and (b) Palm problems.

For (a), we show that, if the Markov process is strong Markov, then it is again a strong Markov process under the Palm distribution, and its transition operator is unchanged. However, the jump transition of the Markov process at a counting instant of each point process may require the predictability of those instants. For (b), we make it clear under what framework it can be well handled. We also discuss how those results can be applied in deriving BAR's for queueing networks.

Obliquely reflecting diffusions in curved, nonsmooth domains

Cristina Costantini Università di Chieti-Pescara IS

Obliquely reflecting diffusions in curved, nonsmooth domains, arise, for instance, in diffusion approximation of certain stochastic networks (switched networks, networks operating under resource sharing). In a polyhedral domain with constant direction of reflection on each face, Dai and Williams (1996) find very general conditions on the directions of reflection under which reflecting Brownian motion can be constructed and uniquely characterized. These conditions are necessary for simple polyhedrons. For a curved, nonsmooth domain and varying direction of reflection, there were several important results in the 1980s and 1990s, but all of them under conditions restrictive in some respect. In this talk, after briefly reviewing the main results in the literature, I will discuss a series of recent joint papers with T.G. Kurtz (published and unpublished) that present a new construction of semimartingale reflecting diffusions and new uniqueness results in some types of domains. In particular, we obtain existence and uniqueness in a 2-dimensional piecewise smooth domain, under very general, geometric, easily verifiable conditions. In fact our conditions are optimal in the sense that they reduce to those of Dai and Williams (1996) in the case of a polyhedron with constant direction of reflection on each face. Moreover our conditions allow for cusps in the boundary of the domain. The construction part of our work is based on constrained martingale problems, while the uniqueness part is based on a new reverse ergodic theorem for killed, inhomogeneous Markov chains that, in a sense, generalizes the Krein-Rutman theorem used in Kwon and Williams (1991).

On the diameter of the stopped spider process

Philip Ernst Imperial College London IS

We consider the « Brownian spider » (Walsh Brownian motion), which is constructed as a set of half-lines, or "ribs," meeting at a common point O. A Brownian motion on a spider starting at zero may be constructed from a standard reflecting Brownian motion by assigning an integer uniformly and independently to each excursion which is then transferred to an excursion on rib.

In the early 2000s, Lester Dubins posed the following problem: how can one design a stopping time to maximize the coverage of Brownian motion on the spider for a given expected time? Dubins et al. (2009) provided a solution to the optimal strategy for n=1,2 ribs, and Ernst (2016) gave an alternative solution to that presented by Dubins et al. (2009). However, neither Dubins et al. (2009) nor Ernst (2016) succeeded in providing a solution to the general question.

Over the past few years, we studied an alternative version of Dubins' question in which the coverage or size of the spider process is measured differently. Instead of measuring the spider as the sum of the lengths of its ribs, we consider the 'true' diameter, that is, the sum of the two longest ribs. The resulting optimal stopping problem can, rather surprisingly, be completely solved. This work (to appear, Mathematics of Operations Research, 2023) is joint with E. Bednarz and A. Osekowski.

The solution to the original formulation of the Dubins' problem remains open.

Approximation of Liouville Brownian motion

Zhen-Qing Chen University of Washington

IS

Liouville Brownian motion was introduced as a canonical diffusion process under Liouville quantum gravity. It is constructed as a time change of 2-dimensional Brownian motion by the continuous additive functional associated with a Liouville measure, through a regularizing approximation procedure of the Gaussian free field. In this talk, we are concerned with the question whether one can construct Liouville Brownian motion directly from the Liouville measure. We will present a discrete approximation scheme that in fact works for any time-changed Brownian motion by a Revuz measure that has full support. Based on joint work with Yang Yu.

Diffusion Limits for Multiclass Processor Sharing Queues

Amber Puha California State University San Marcos

IS

Consider a single server queue that serves a finite number heterogeneous job types according to the processor sharing service discipline. Measure valued processes that keep track of the residual service times of all jobs in the system at any given time are a natural descriptor of the system state. Under appropriate asymptotic assumptions, including standard heavy traffic assumptions, we show that (suitably rescaled) measure valued processes corresponding to a sequence of such queues converge in distribution to certain measure valued diffusion processes. An important contribution of this work is to devise a new methodology for establishing state-space collapse via the use of a certain relative entropy functional.

Sensitivity analysis of obliquely reflected diffusions in convex polyhedral domains

David Lipshutz Flatiron Institute

IS

Sensitivity analysis of an obliquely reflected diffusion in a convex polyhedral domain with respect to its defining parameters (initial condition, drift coefficient, diffusion coefficient and directions of reflection) is of interest from both theoretical and applied perspectives. In this talk, we characterize pathwise derivatives of such reflected diffusions in terms of solutions to a linear constrained stochastic differential equation whose coefficients, domain and directions of reflection depend on the state of the reflected diffusion. We demonstrate how pathwise derivatives are useful in Monte Carlo methods to estimate sensitivities of a reflected diffusion, and also in characterizing sensitivities of the stationary distribution of a reflection Brownian motion. This work is joint with Kavita Ramanan.

Lévy driven non-linear Langevin type equations

Mihai Gradinaru IRMAR

IS

We will study a one-dimensional kinetic stochastic model driven by a stable Lévy process, and having a non-linear time-inhomogeneous drift. More precisely, a process (V, X) is considered, where X is the position of a particle having velocity V the solution of a stochastic differential equation with a drift of the form $t^{-\beta}F(V)$ and driven by a stable process. The behaviour of the process (V, X) will be described for two different situations : when the noise is small, or in large time but with fixed noise.

Multidimensional singular control and related Skorokhod problem: sufficient conditions for the characterization of optimal controls

Jodi Dianetti Center for Mathematical Economics, Bielefeld University **PD**

We characterize the optimal control for a class of singular stochastic control problems as the unique solution to a related Skorokhod reflection problem. The optimization problems concern the minimization of a discounted cost over an infinite time-horizon through a process of bounded variation affecting an Itô-diffusion. The setting is multidimensional, the drift of the state equation and the costs are convex, the volatility matrix can be constant or linear in the state. Our result applies to a relevant class of linear-quadratic models and it allows to construct the optimal control in degenerate and non degenerate settings considered in the literature.

Matsumoto-Yor and Dufresne type theorems for a random walk on positive definite matrices

Jonas Arista Bielefeld University **PD**

We establish analogues of the geometric Pitman $2M - X$ theorem of Matsumoto and Yor and of the classical Dufresne identity, for a multiplicative random walk on positive definite matrices with Beta type II distributed increments. The Dufresne type identity provides another example of a stochastic matrix recursion that admits an explicit solution.

Reflected Brownian motions and random growth models

Will FitzGerald University of Manchester **PD**

I will discuss an identity between the invariant measure of a reflected system of Brownian motions and a vector of point-to-line last passage percolation times. By time reversal, this describes the distribution of the maximum over all time of the largest eigenvalue in Dyson Brownian motion with negative drifts. A positive temperature version relates the point-to-line partition functions of two directed polymers in an inverse-gamma and Brownian environment, and generalises Dufresne's identity.

Friday, April 28

Lévy driven queues: the workload correlation function is positive, decreasing and convex

Michel Mandjes Univ. of Amsterdam

IS

In this talk I will consider Lévy-driven queues, i.e., reflected Lévy processes, generalising the class of reflected Brownian motions, with a focus on structural properties of the workload correlation function. After having introduced the objects studied, I'll proceed by stating the conjecture that has been around for quite a while, namely that the workload correlation is a positive, decreasing and convex function of time. As a historic account, I'll briefly discuss the seminal contribution by Ott on the special case of the M/G/1 queue, based on exploiting properties of complete monotone functions. The same methodology has been used in the extension (by Es-Saghouani and me) to queues with spectrally positive Lévy input, whereas later (in a paper by Glynn and me) the spectrally negative case was dealt with. For a long time, there was little hope to prove the conjecture for general Lévy input (and, for that matter, for reflected random walks in discrete-time). In a recent paper (that I wrote with Berkelmans and Cichocka), we provide an elementary proof, only relying on basic properties of Lévy processes and their reflected version. Importantly, the argumentation extends to double reflection, and also covers reflected random walks. Time permitting, I also discuss various ramifications due to Kella and me, and I comment on the question whether the structural properties carry over to the Markov modulated case.

Parameter estimation for skew/sticky BM

Sara Mazzonetto Université de Lorraine

IS

In this talk we consider some one-dimensional diffusions whose behavior is perturbed by a barrier-point. The perturbation nature of partial-reflection (skew BM) or sticky is encoded by a parameter. Our goal is to discuss parameter estimation from high-frequency observations of a trajectory. In particular, in the case of skew BM we discuss the main properties of the Maximum Likelihood Estimator (MLE) such as asymptotic mixed normality with a non standard rate of 1/4 and the behavior for all possible values of the parameter. Moreover, thanks to a recent asymptotic inverse function theorem, we give an infinite series expansion of the MLE. This talk is partially based on a joint works with A. Anagnostakis (LJK Grenoble) and A. Lejay (IECL/Inria Nancy)

RBM with Drift in a Wedge

Josh Reed NYU Stern

IS

We study reflecting Brownian motion with drift constrained to a wedge in the plane. Our first set of results provide necessary and sufficient conditions for existence and uniqueness of a solution to the corresponding submartingale problem with drift. Next, we study a version of the problem with absorption at the vertex of the wedge. In this case, we provide a condition for existence and uniqueness of a solution to the problem and some results on the probability of the vertex being reached. We also prove that in the case of 1 < alpha < 2, RBM in a wedge is a Dirichlet process. Specifically, its unique Doob-Meyer type decomposition is given by Z=X+Y, where X is a two-dimensional Brownian motion and Y is a continuous process of zero energy. Furthermore, we show that for p > alpha , the strong p-variation of the sample paths of Y is finite on compact intervals, and, for 0 < p <= alpha, the strong p-variation of Y is infinite on [0,T] whenever Z has been started from the origin. We also show that on excursion intervals of Z away from the origin, (Z,Y) satisfies the standard Skorokhod problem for X. However, on the entire time horizon (Z,Y) does not satisfy the standard Skorokhod problem for X, but nevertheless we show that it satisfies the extended Skorkohod problem.

Competing diffusive particle systems and models of large equity markets

Ioannis Karatzas Columbia University

IS

We introduce and study stable multidimensional diffusions interacting through their ranks. These interactions give rise to invariant measures which are in broad agreement with stability properties observed in large equity markets over long time-periods. The models we present assign growth rates and variances that depend on both the name (identity) and the rank (according to capitalization) of each individual asset. Such models are able realistically to capture certain critical features of the observed stability in capital distribution over the past century, all the while being simple enough to allow for rather detailed analytical study.

The methodologies used in this study touch upon the question of triple points for systems of competing diffusive particles; in particular, some choices of parameters may permit triple (or higher-order) collisions to occur. We show, however, that such multiple collisions have no effect on any of the stability properties of the resulting system. This is accomplished through a detailed analysis of collision local times.

The models have connections with the analysis of Queueing Networks in heavy traffic, with multi-dimensional Diffusions reflected on the faces of the positive orthant, and with competing particle systems in Statistical Mechanics (e.g., Sherrington- Kirkpatrick model for spin-glasses). Their hydrodynamic-limit behavior is governed by generalized porous medium equations with convection, and the fluctuations around these limits by appropriate linear stochastic partial differential equations of parabolic type with additive noise. Whereas, limits of a different kind display phase transitions and are governed by Poisson-Dirichlet distributions. We survey progress on some of these fronts, and suggest open problems for further study.

List of Participants

Andres	Sebastian	University of Manchester
Arista	Jonas	Bielefeld University
Assiotis	Theo	University of Edinburgh
Ata	Baris	University of Chicago
Atar	Rami	Technion
Blanchet	Jose	Stanford
Bousquet-Mélou	Mireille	CNRS, LaBRI, Université de Bordeaux
Boxma	Onno	Eindhoven University of Technology
Bramson	Maury	University of Minnesota
Bresar	Miha	University of Warwick
Budhiraja	Amarjit	University of North Carolina at Chapel Hill
Burdzy	Krzysztof	University of Washington
Chapon	Francois	Institut de Mathématiques de Toulouse
Chaumont	Loïc	Université d'Angers
Chen	Xinyun	Chinese University of Hong Kong, Shenzhen
Chen	Zhen-Qing	University of Washington
Costantini	Cristina	Università di Chieti-Pescara
Dai	Jim	Cornell University and CUHK-Shenzhen
Debicki	Krzysztof	Mathematical Institute, University of Wroclaw
Defosseux	Manon	Université Paris Cité
Dianetti	Jodi	Center for Mathematical Economics, Bielefeld University
Ernst	Philip	Imperial College London
Es-Sebaiy	Khalifa	Kuwait University
Estevez	Benjamin	University of North Carolina at Chapel Hill
Fayolle	Guy	Inria (Paris Saclay)
Ferrari	Giorgio	Universität Bielefeld
FitzGerald	Will	University of Manchester
Flin	Jules	Université de Lorraine
Franceschi	Sandro	Télécom SudParis
Gradinaru	Mihai	IRMAR
Guang	Jin	The Chinese University of Hong Kong, Shenzhen
Guérin	Hélène	Université du Québec à Montréal
Harrison	J. Michael	Stanford University
Hasenbein	John	University of Texas at Austin, USA
Hérent	Charlie	Université Paris Cité (MAP5) / Univ Gustave Eiffel (LIGM)
Housley	Benjamin	University of Manchester
Ichiba	Tomoyuki	University of California Santa Barbara
Ignatiouk-Robert	Irina	Université de Cergy-Pontoise
Jacobovic	Royi	University of Amsterdam
Karatzas	Ioannis	Columbia University
Kella	Offer	The Hebrew University of Jerusalem

Kelly	Frank	University of Cambridge
Kourkova	Irina	Sorbonne Universite
Krell	Nathalie	université Rennes 1
Lakner	Peter	New York University
Lipshutz	David	Flatiron Institute
Mandjes	Michel	Univ. of Amsterdam
Mazzonetto	Sara	Université de Lorraine
Mijatovic	Aleksandar	University of Warwick
Miyazawa	Masakiyo	Tokyo University of Science
Nessmann	Andreas	Technische Universität Wien, Université de Tours
Nguyen	Thi Trang	Laboratoire de Mathématiques Bretagne Atlantique, UBS
O'Connell	Neil	University College Dublin
Petit	Maxence	Sorbonne Université / ENS Rennes
Puha	Amber	California State University San Marcos
Ramanan	Kavita	Brown University
Raschel	Kilian	CNRS, Université d'Angers
Reed	Josh	NYU Stern
Sarantsev	Andrey	University of Nevada, Reno
Sauzedde	Isao	University of Warwick
Schehr	Gregory	CNRS-Sorbonne Université
Si	Nian	The University of Chicago, Booth School of Business
Wachtel	Vitali	Universität Bielefeld
Walsh	Harriet	Université d'Angers
Williams	Ruth	University of California, San Diego
Zhang	Zhiqiang	The University of Chicago Booth School of Business

List of Posters

Brownian motion with asymptotically normal reflection in unbounded domains: from transience to stability

Miha Bresar, *University of Warwick*

Wasserstein bounds in the CLT of the MLE for the drift coefficient of a stochastic partial differential equation

Khalifa Es-Sebaiy, *Kuwait University*

Absorption probability of a reflected Brownian in a cone and Tutte invariants

Jules Flin, *Université de Lorraine - Télécom Sud Paris*

Uniform Moment Bounds for Generalized Jackson Networks in Multi-scale Heavy Traffic

Jin Guang, *The Chinese University of Hong Kong*, *Shenzhen*

Asymptotics of Green's functions of reflected Brownian in a quadrant

Maxence Petit, *Sorbonne Université - ENS Rennes*

Routing in a Queueing Loss Model under Imperfect Classifications

Zhiqiang Zhang, *The University of Chicago Booth School of Business*

Special issue of « Queueing Systems »

Queueing Systems: Theory and Applications is seeking submissions to a forthcoming Special Issue on Reflected Brownian Motion. Reflected Brownian Motion (RBM) forms an important research domain in probability, with strong links within queueing theory. A famous example is Heavy Traffic Limits theorems for Queueing Networks which determine convergences of queues towards RBM. This Special Issue aims to publish articles on reflected stochastic processes and their applications in other fields of mathematics.

This special issue has been motivated by the conference and it covers all themes included in the conference. Thus in the same spirit of the conference, it intends to reflect the diversity of RBM topics: from the historical beginnings of the study of RBM to new developments and applications. The call for articles is open to all (not only to conference participants).

We identify a few key topics (the following list is non-exhaustive!):

RBM and queuing systems/risk models ; RBM and boundary value problems / complex analysis / asymptotic techniques ; RBM in higher dimension ; Pathwise properties of RBM ; RBM as an exactly solvable model (exponential stationary distributions, etc.) ; Stochastic processes related to RBM (reflected diffusions in polyhedral domains, etc.) ; The history of RBM.

The submission deadline is September 30, 2023.

The call for papers and the submissions process may be found here:

`https://www.springer.com/journal/11134/updates/23636094`

If you are interested in submitting your work to this special issue, please let us know. The three organizers of the conference Sandro Franceschi, Héléne Guerin, Kilian Raschel, together with Michel Mandjes member of the scientific committee of the conference as well as editor-in-chief of «Queueing Systems», will be acting as the guest editors. Please don't hesitate to ask us, if you have any questions regarding this special issue!

Useful Information

Place

The conference will take place in April 24-28, 2023 in Brittany in France, in the (small) city of Roscoff, where there is a beautiful CNRS conference center. **Talks** will be held at the conference center **Place Georges Teissier**.

Accommodation

You will be accommodated in three different hotels: **Hotel Gulf Stream, Hotel de France and Hotel d'Angleterre**. Hotel de France and Hotel d'Angleterre are very close to the conference center, Hotel Gulf Stream is at a 15-minute walk.

Meals

Accommodation and meals will be taken at Hôtel Le Gulf Stream from the Sunday evening until Friday noon (except the meal on Sunday evening). Dinner is at 7:30 p.m every day. The **conference dinner** will be held on Tuesday.

Excursion

An excursion to **Ile de Batz** is planned **Wednesday**, April 26. The walk on the Ile de Batz is generally very popular with lecturers (10 mn sea crossing). The **boat leaves at 14:30** and the departure is at *Quai Neuf* ("Les Vedettes de l'Ile de Batz" compagny).

Poster session

The **poster session** will be held on Wednesday before the dinner at Gulf Stream Hotel at 18:30.

Wifi

Wi-Fi will be available during the conference. Instruction connection will be given.

Partner Institutions and Sponsors

This meeting take place CNRS conference center Station biologique de Roscoff and is funded by the Centre Henri Lebesgue, the ANR JCJC grant « RESYST » and the ERC grant « Elliptic Combinatorics ».

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B Hôtel de France

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2 Bâtiment Institut de génomique marine

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