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A Solution to the Time-Scale Fractional Puzzle in the Implied Volatility

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In the option pricing literature, it is well known that (i) the decrease in the smile amplitude is much slower than the standard stochastic volatility models and (ii) the term structure of the at-the-money volatility skew is approximated by a power-law function with the exponent close to zero. These stylized facts cannot be captured by standard models and, while (i) has been explained by using a fractional volatility model with Hurst index $H > 1/2$, (ii) is proved to be satisfied by a {\it rough} volatility model with $H < 1/2$ under a risk-neutral measure. This paper provides a solution to this fractional puzzle in the implied volatility. Namely, we construct a two-factor fractional volatility model and develop an approximation formula for European option prices. It is shown through numerical examples that our model can resolve the fractional puzzle, when the correlations between the underlying asset process and the factors of rough volatility and persistence belong to a certain range. More specifically, depending on the three correlation values, the implied volatility surface is classified into four types: (1) the roughness exists, but the persistence does not; (2) the persistence exists, but the roughness does not; (3) both the roughness and the persistence exist; and (4) neither the roughness nor the persistence exist. (Joint work with H. Funahashi)

Summary:

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BSDE formulation of combined regular and singular stochastic control problems

Ying Hu[1]

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In this talk, we study a class of combined regular and singular stochastic control problems that can be expressed as constrained BSDEs. In the Markovian case, this reduces to a characterization through a PDE with gradient constraint. But the BSDE formulation makes it possible to move beyond Markovian models and consider path-dependent problems. We also provide an approximation of the original control problem with standard BSDEs that yield a characterization of approximately optimal values and controls.
This is a joint work with Bruno Bouchard and Patrick Cheridito.

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Can old-age provision benefit from recent developments in quantitative finance?

Michael Schmutz[1]

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Among other factors, the difficult market environment with its sustained low interest rates triggers certain adjustments of investment and product strategies of life insurance companies and pension funds. In this context, the role of life insurance companies and pension funds as long-term investors has increasingly been discussed among the industry and financial market supervisory authorities. These discussions are often focused on the idea of trying to benefit from the possibility of long-term hold to maturity strategies partially based on assets providing a certain illiquidity premium. This idea is compared to alternative ideas regarding investment or resolution plans for life insurance portfolios, some of which are based on recent developments in quantitative finance. Furthermore, the link between investment plans and product design will also be briefly discussed.

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Classical and Restricted Impulse Control for the Exchange Rate under Incomplete Knowledge of the Model

Auteur(s): Wolfgang Runggaldier[1]

Co-auteur(s) Kazuhiro Yasuda [2]

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ABSTRACT: We consider the problem faced by a Central Bank of optimally controlling the exchange rate over a finite time horizon, whereby it can use two non-excluding tools: controlling directly the exchange rate in the form of an impulse control; controlling it indirectly via the domestic exchange rate in the form of a continuously acting control. In line with existing literature we consider this as a mixed classical-impulse control problem for which, on the basis of a quasi-variational inequality, we search for an analytic solution within a specific class of value functions and controls. Besides the finite horizon, the main novelty here is the assumption that the drift in the exchange rate dynamics is not directly observable and has thus to be filter-estimated from observable data. The problem becomes thus time inhomogeneous and the Markovian state variables have to include also the filter of the drift. This is a joint work with

Kazuhiro Yasuda.

Summary:

54

Construction of an aggregate consistent utility, without Pareto optimality

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Co-auteur(s) Mohamed Mrad [2] ; Nicole El Karoui El Karoui [3]

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The aim of this talk is to describe globally the behavior and preferences of heterogeneous agents. Our starting point is the aggregate wealth of a given economy, with a given repartition of the wealth among investors, which is not necessarily Pareto optimal.
We propose a construction of an aggregate forward utility, market consistent, that aggregates the marginal utility of the heterogeneous agents. This construction is based on the aggregation of the pricing kernels of each investor. As an application we analyze the impact of the heterogeneity and of the wealth market on the yield curve.

This is a joint work with Nicole El Karoui and Mohamed Mrad.

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Continuous-Time Constrained Stochastic Linear-Quadratic Control with Financial Applications

Auteur(s): Xun LI[1]

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This work studies a class of continuous-time scalar-state stochastic Linear-Quadratic (LQ) optimal control problem with the linear control constraints. Using the state separation theorem induced from its special structure, we derive the analytical solution for this class of problem. The revealed optimal control policy is a piece-wise affine function of system state. This control policy can be computed efficiently by solving two Riccati equations off-line. Under some mild conditions, the stationary optimal control policy can be also achieved for this class of problem with infinite horizon. This result can be applied to solve the constrained dynamic mean-variance portfolio selection problem. Examples shed light on the solution procedure of implementing our method.

Summary:

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Controlled mean-field dynamics in stochastic control problems depending on the law of state process

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The starting point of the talk is a recent work with Juan Li (Shandong University, Weihai, P.R.China) and Jin Ma (University of South California, Los Angeles, U.S.A.), “A mean-field stochastic control problem with partial observations” (Annals of Appl.Probability, 2017: [1]) in which we studied Pontryagin’s optimality principle for a stochastic control problem whose dynamics are given by the stochastic differential equation (SDE)
Z t
Z t
X|Y
X t = x +
b(s, X .∧s , µ s , u s (Y))ds +
σ(s, X .∧s , µ s X|Y , u s (Y))dB s 1 ,
0

0
R t
Y t = 0 h(s, X s)ds + B t 2 , t ∈ [0, T], P -a.s.,
where (B 1 , B 2) is a P -Brownian motion, the controlled state process X is only observable through the observation process Y and so the control process u = u(Y) is a non anticipating functional of the observation process Y . Moreover, unlike classical controlled dynamics, the coefficients σ and b do not only depend on the paths of the controlled state process X and the control u(Y) but also
X|Y
on the law μ s = P ◦ [E[X s |Y r , r ≤ s]] −1 , s ∈ [0, T]. Motivations for such a type of dynamics are given in [1]. However, in [1] the dependence of the law is linear; the talk will study the case where the coefficients are non linear functions of the law. Moreover, unlike in [1] the coefficients b and σ are only supposed to be continuous in the law w.r.t. the 1-Wasserstein metric and on h we only impose boundedness and Lipschitz continuity in the state variable. The main objective of the talk is to prove the weak existence and the uniqueness in law for the above dynamics.

Summary:

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Couplings on Wiener space and a new version of Talagrand's inequality

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We discuss adaptive and anticipating couplings on Wiener space. In particular we take a fresh look at the connection between the Wasserstein metric and the relative entropy with respect to Wiener measure provided by Talagrand's inequality and its extension to Wiener space by Feyel and Ustunel. Using results of Nina Gantert for large deviations in the quadratic variation of Brownian motion, we extend this inequality beyond the absolutely continuous case, using the notion of specific relative entropy.

Summary:

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Decomposition of random times, application to default times

Co-auteur(s) Anna Aksamit ; Tahir Choulli

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We provide a general model of default time, extending the models of Jiao and Li (modelling sovereign risks) and Gehmlich and Schmidt (dynamic defaultable term structure modelling beyond intensity paradigm).
We show that any random time τ can be decomposed in two parts as τ = τ 1 ∧τ 2 under the condition that the first random time τ 1 avoids stopping times in the reference filtration F, and the second time τ 2 is thin, i.e., its graph is included in a countable union of graphs of stopping times in the reference filtration F. Under the condition τ 1 ∨ τ 2 = ∞, the decomposition is unique. This decomposition is based on a study of the dual optional projection of τ , as the decomposition of a stopping time into accessible and totally inaccessible is based on the dual predictable projection. We show that for a thin time τ 2 , any F-martingale is a semimartingale in its progressive enlargement with τ 2 and we give its semimartingale decomposition. We prove that any martingale in the reference filtration is a semimartingale in the progressive enlargement with τ if and only if the same property holds for the progressive enlargement with τ 1 and we give its semimartingale representation. We establish in that the immersion property holds for τ if and only if it holds for τ 1 .This is a joint work with Anna Aksamit and Tahir Choulli.

Summary:

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Double continuation regions for American and Swing options with negative discount rate in Lévy models

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In this talk we
analyze perpetual American call and put options in an exponential L\'evy model.
We consider a negative effective discount rate which arises in a number of financial applications including stock loans and real options, where the strike price can potentially grow at a higher rate than
the original discount factor. We show that in this case a double continuation region arises and we identify the two critical prices.
We also generalize this result to multiple stopping problems of swing type, that is, when successive exercise opportunities are separated by i.i.d. random
refraction times. We conduct numerical analysis for the Black-Scholes model and
the jump-diffusion model with exponentially distributed jumps.

Summary:

70

Duality for homogeneous optimisation problems

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This talk is concerned with stochastic optimal control problems with a certain homogeneity. For such problems, a novel dual problem is formulated. The results are applied to a stochastic volatility variant of the classical Merton problem. Another application of this duality is to the study the right-most particle of a branching Levy process.

Summary:

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Entropy and additional utility of a discrete information disclosed progressively in time

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The additional information carried by enlarged filtration and its measurement was studied by several authors. Already Meyer (Sur un theoreme de J. Jacod, 1978) and Yor (Entropie d'une partition, et grossissement initial d'une filtration, 1985), investigated stability of martingale spaces with respect to initial enlargement with atomic sigma-field. We extend these considerations to the case where information is disclosed progressively in time. We define the entropy of such information and we prove that its finiteness is enough for stability of some martingale spaces in progressive setting. Finally we calculate additional logarithmic utility of a discrete information disclosed progressively in time.

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Ergodic BSDEs with unbounded and multiplicative underlying diffusion

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In this talk, we deal with Ergodic Backward Stochastic Differential Equations for which the underlying SDE (in finite dimension) has a sublinear diffusion. Hu, Madec and Richou have recently studied those
equations, but with an additive noise (and in infinite dimension). First, we show existence and uniqueness of the solution under assumptions similar to their work (especially weak dissipativity of the drift for the underlying SDE). Then, we obtain
the large time behaviour of viscosity solutions of HJB equations.

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Esscher pricing under progressive enlargement of information

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We investigate the Esscher pricing rule and the Esscher prices, when the "public" flow information denoted by $\mathbb{F}$ is progressively enlarged by a random time τ, for both discrete-time and continuous-time settings. τ can represent the death time of an agent, default time of a firm, or more generally the occurrence time of an even that might impact the market somehow. Thus, by considering the new flow of information $\mathbb{G}$ resulting from the expansion of the flow $\mathbb{F}$ with τ, we address the stopped model $(S^{\tau},\mathbb{G})$ in different directions and various frameworks. In discrete time, for instance, we describe the Esscher martingale measure for the general case in different manners, and we illustrate the results on particular cases of models for the pair (S,τ). To well illustrate the impact of τ on the Esscher pricing rules and/or prices, we consider the Black-Scholes model for S and a class of models for τ. For these models, we describe the Esscher martingale measures, the Esscher prices for some death-linked contracts, the Greeks of these obtained Esscher prices, and we compare the Esscher prices with the Black-Scholes pricing formula. This talk is based on joint work with Haya Alsemary (University of Alberta).

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Exact spectral asymptotics of fractional processes with applications to inference

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Many problems of statistical inference can be solved, using spectral decomposition of stochastic processes. The principal difficulty with this approach is that eigenproblems are notoriously hard to solve in a reasonably explicit form. In this talk I will survey some recent results on the exact asymptotics in eigenproblems for fractional processes and discuss their applications to parameter estimation and filtering.

Summary:

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General Equilibrium Under Convex Portfolio Constraints and Heterogeneous Risk Preferences

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This paper characterizes the equilibrium in a continuous time financial market populated by heterogeneous agents who differ in their rate of relative risk aversion and face convex portfolio constraints. The model is studied in an application to margin constraints and found to match real world observations about financial variables and leverage cycles. It is shown how margin constraints increase the market price of risk and decrease the interest rate by forcing more risk averse agents to hold more risky assets, producing a higher equity risk premium. In addition, heterogeneity and margin constraints are shown to produce both pro- and counter-cyclical leverage cycles. Beyond two types, it is shown how constraints can cascade and how leverage can exhibit highly non-linear dynamics. Finally, empirical results are given, documenting a novel stylized fact which is predicted by the model, namely that the leverage cycle is both pro- and counter-cyclical.

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Generalized Feller processes and Markovian lifts of stochastic Volterra processes: the affine case

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We consider stochastic (partial) differential equations appearing as Markovian lifts of affine Volterra processes with jumps from the point of view of the generalized Feller property which was introduced in, e.g., Dörsek-Teichmann (2010). In particular we provide new existence, uniqueness and approximation results for Markovian lifts of affine rough volatility models of general jump diffusion type. We demonstrate that in this Markovian light the theory of stochastic Volterra processes becomes almost classical.

Summary:

66

Infinite dimensional polynomial processes

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Motivated from high and infinite dimensional problems in mathematical finance, we consider infinite dimensional polynomial processes taking values in certain space of measures or functions. We have two concrete applications in mind: first, modeling high or even potentially infinite dimensional financial markets in a tractable and robust way, and second analyzing stochastic Volterra processes, which recently gained popularity through rough volatility models and ambit processes. The first question leads to probability measure valued polynomial diffusions and the second one to Markovian lifts of polynomial Volterra processes. For both cases we provide existence results and a moment formula.

Summary:

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Law of Large Numbers and Central Limit Theorem under Uncertainty of Probability Distributions

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How to calculate the essential uncertainty of probability distributions hidden behind a real data sequence is a theoretically and practically important challenging problem.

Recently some fundamentally important progresses have been achieved in the domain of law of large numbers (LLN) and central limit theorem (CLT) with a much weaker assumption of independence and identical distribution (i.i.d.) under a sublinear expectation.

These new LLN and CTL can be applied to a significantly wide classes of data sequence to construct the corresponding optimal estimators. In particular, many distribution uncertainties hidden behind data sequences are able to be quantitatively calculated by introducing a new algorithm of phi-max-mean type.

In this talk, I take some typical examples to provide a more concrete explanation of the above mentioned LLN and CLT, the key idea of their proofs, as well as the new phi-max-mean estimators.

Summary:

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Lie group analysis of an optimization problem for a portfolio with an illiquid asset

Auteur(s): Ljudmila A. Bordag[1]

Co-auteur(s) Ivan P. Yamshchikov [2]

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Working in the Merton's optimal consumption framework with continuous time we consider an optimization problem for a portfolio with an illiquid, a risky and a risk-free asset. Our goal in this paper is to carry out a complete Lie group analysis of PDEs describing value function and investment and consumption strategies for a portfolio with an illiquid asset that is sold in an exogenous random moment of time T with a prescribed liquidation time distribution. The problem of such type leads to three dimensional nonlinear Hamilton-Jacobi-Bellman (HJB) equations. Such equations are not only tedious for analytical methods but are also quite challenging form a numeric point of view. To reduce the three-dimensional problem to a two-dimensional one or even to an ODE one usually

uses some substitutions, yet the methods used to find such substitutions are rarely discussed by the authors.

We use two types of utility functions: general HARA type utility and logarithmic utility. We carry out the Lie group analysis of the both three dimensional PDEs and are able to obtain the admitted symmetry algebras. Then we prove that the algebraic structure of the PDE with logarithmic utility can be seen as a limit of the algebraic structure of the PDE with HARA-utility as $\gamma \to 0$. Moreover, this relation does not depend on the form of the survival function $\overline{\Phi}(t)$ of the random liquidation time T.
We find the admitted Lie algebra for a broad class of liquidation time distributions in cases of HARA and log utility functions and formulate corresponding theorems for all these cases.

We use found Lie algebras to obtain reductions of the studied equations. Several of similar substitutions were used in other papers before whereas others are new to our knowledge. This method gives us the possibility to provide a complete set of non-equivalent substitutions and reduced equations.

We also show that if and only if the liquidation time defined by a survival function $\overline{\Phi}(t)$ is distributed exponentially, then for both types of the utility functions we get an additional symmetry. We prove that both Lie algebras admit this extension, i.e. we obtain the four dimensional L_4^{HARA} and L_4^{LOG} correspondingly for the case of exponentially distributed liquidation time.
We list reduced equations and corresponding optimal policies that tend to the classical Merton policies as illiquidity becomes small.

This research was supported by the European Union in the FP7-PEOPLE-2012-ITN Program under Grant Agreement Number 304617 (FP7 Marie Curie Action, Project Multi-ITN STRIKE - Novel Methods in Computational Finance)

65

Linear-Quadratic-Gaussian Mixed Games with Input Constraint Involving Major Agent and Heterogeneous Minor Agents

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We consider a class of linear-quadratic-Gaussian mean-field games with a major agent and considerable heterogeneous minor agents with mean-field interactions. The individual admissible controls are constrained in closed convex subsets of the full space. The decentralized strategies for individual agents and the consistency condition system are represented in an unified manner via a class of mean-field forward-backward stochastic differential equation involving projection operators. The well-posedness of consistency condition system is established and the related ε–Nash equilibrium property is also verified.

Summary:

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Mass-Conserving Stochastic Partial Differential Equations and Related Backward Doubly Stochastic Differential Equations

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In this talk, i will introduce a type of mass-conserving stochastic partial differential equations which can be connected with a type of mass-conserving backward doubly stochastic differential equations. The Poincare's inequality is used in the estimates to relax the monotonic condition of backward doubly stochastic differential equations.

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Mixed Deterministic and Random Optimal Control of Linear Stochastic Systems with Quadratic Costs

Auteur(s): Shanjian Tang[1]

Co-auteur(s) Ying Hu [2]

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[2] *Université Rennes 1*

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We consider the mixed optimal control of a linear stochastic system with a quadratic cost functional, with two controllers—one can choose only deterministic time functions, called the deterministic controller, while the other can choose adapted random processes, called the random controller. The optimal control is shown to exist under suitable assumptions. The optimal control is characterized via a system of fully coupled forward-backward stochastic differential equations (FBSDEs) of mean-field type. We solve the FBSDEs via solutions of two (but decoupled) Riccati equations, and give the respective optimal feedback law for both deterministic and random controllers, using solutions of both Riccati equations. The optimal state satisfies a linear stochastic differential equation (SDE) of mean-field type. Both the singular and infinite time-horizonal cases are also addressed.

This is a joint work with Ying HU, Universite de Rennes 1.

55

Nonparametric Bayesian volatility estimation

Peter Spreij[1]

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Given discrete time observations over a fixed time interval, we study a nonparametric Bayesian approach to estimation of the volatility coefficient of a stochastic differential equation. We postulate a histogram-type prior on the volatility with piecewise constant realisations on bins forming a partition of the time interval. The values on the bins are assigned an inverse Gamma Markov chain (IGMC) prior. Posterior inference is straightforward to implement via Gibbs sampling, as the full conditional distributions are available explicitly and turn out to be inverse Gamma. We also discuss in detail the hyperparameter selection for our method. Our nonparametric Bayesian approach leads to good practical results in representative simulation examples. Finally, we apply it on a classical data set in change-point analysis: weekly closings of the Dow-Jones industrial averages. [Joint work with Shota Gugushvili, Moritz Schauer and Frank van der Meulen.]

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On Fairness of Systemic Risk Measures

Marco Frittelli[1]

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In our previous paper, we have introduced a general class of systemic risk measures that allow random allocations to individual banks before aggregation of their risks. In the present paper, we address the question of fairness of these allocations and we propose a fair allocation of the total risk to individual banks. We show that the dual problem of the minimization problem which identify the systemic risk measure, provides a valuation of the random allocations which is fair both from the point of view of the society/regulator and from the individual financial institutions. The case with exponential utilities which allows for explicit computation is treated in details.

86

On discrete Schur-constant vectors, with applications.

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This talk is concerned with Schur-constant survival models for discrete random variables. Our main purpose is to prove that the associated partial sum process is a non- homogeneous Markov chain. This is shown in different cases as the random variables take values in the set of nonnegative integers or in the set of integers smaller than $m \geq 1$. The property of Schur-constancy is also compared for thesecases. We also present a few additional results on Schur-constant vectors. This is based on joint works with Castaner, Claramunt, Lefèvre and Utev.

Summary:

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On multisided optimal stopping problems for Levy processes

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In the last decades solving multisided optimal stopping problems was of interest.

We will show how to approach the above problems for Levy processes if the payoff function is an exponential polynomial (possibly multidimensional), and present several examples. The method we use is based on Appell integral transform.

Summary:

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On sets of laws of continuous martingales

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We discuss relations between sets of laws of stochastic integrals with respect to a Wiener process and general continuous martingales having quadratic characteristics whose RN-derivatives evolve in the
same convex set of positive semidefinite symmetric matrices.

Summary:

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On the Entropie Minimal Martingale Measure for Lévy Processes

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We consider a geometric Lévy market with asset price S t = S 0 exp(X t), where X is a general Lévy process on (Ω, F, P), and interest rate equal to zero. As it is well known, except for the cases that X is a Brownian motion or a Poisson process, the market is incomplete. Therefore, if the market is arbitrage-free, there are many equivalent martingale measures and the problem arises to choose an appropriate martingale measure for pricing contingent claimes.
One way is to choose the equivalent martingale measure Q ∗ which minimizes the relative entropie to P, if it exists. Another choice is the famous Esscher martingale measure Q E , if it exists.
The main objective of the present talk is to discuss a simple and rigorous approach for proving the fact that the entropie minimal martingale measure Q ∗ and the Esscher martingale measure Q E actually coincide: Q ∗ = Q E . Our method consists of a suitable approximation of the physical probability measure P by Lévy preserving probaility measures P n.
The problem was treated in several earlier papers but more heuristally or in a sophisticated way.

Summary:

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On the Ruin Problem with Investment when the Risky Asset is a Semimartingale

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In this talk, we study the ruin problem with investment in a general framework where the business part X is a Lévy process and the return on investment R is a semimartingale. We obtain upper bounds on the finite and infinite time ruin probabilities that decrease as a power function when the initial capital increases. When R is a Lévy process, we retrieve the well-known results. Then, we show that these bounds are asymptotically optimal in the finite time case, under some simple conditions on the characteristics of X. Finally, we obtain a condition for ruin with probability one when X is a Brownian motion with negative drift and express it explicitly using the characteristics of R. (The results were obtained as a joint work with L. Vostrikova.)

Summary:

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On the conditions on pricing functional and trading strategies in insider trading model

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In this talk I will present some "folk" results in insider trading literature. In particular, I will discuss conditions on pricing functional that are necessary for existence of equilibrium, as well as the ones that are necessary for existence of *inconspicuous* equilibrium. I will prove that one can restrict insider trading strategies to absolutely continuous ones.

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On the geometry of very rough Weierstrass curves: local time, SBR measure, Hausdorff dimension

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We investigate geometric properties of Weierstrass curves with two components, representing series based on trigonometric functions. They are seen to be 12 – Hölder continuous, and are not (para-)controlled with respect to each other in the sense of the recently established Fourier analytic approach of rough path analysis. Their graph is represented as an attractor of a smooth random dynamical system. For one-dimensional versions we show existence of a local time and smoothness of the Sinai-Bowen-Ruelle (SBR) measure. Our argument that its graph has Hausdorff dimension 2 is in the spirit of Ledrappier-Young's approach of the Hausdorff dimension of attractors. This is joint work with G. dos Reis (U Edinburgh) and A. Réveillac (U Toulouse).

Summary:

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Optimal (financial) position targeting via decoupling fields

Stefan Ankirchner[1]

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In the talk we consider a variant of the basic problem of the calculus of variations, where the Lagrangian is convex and subject to randomness adapted to a Brownian filtration. We solve the problem by reducing it, via a limiting argument, to an unconstrained control problem that consists in finding an absolutely continuous process minimizing the expected sum of the Lagrangian and the deviation of the terminal state from a given target position. Using the Pontryagin maximum principle one can characterize a solution of the unconstrained control problem in terms of a fully coupled forward-backward stochastic differential equation (FBSDE). We use the method of decoupling fields for proving that the FBSDE has a unique solution.
The talk is based on joint work with Alexander Fromm, Thomas Kruse and Alexandre Popier.

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Optimal financing and investment strategies under asymmetric information about collateral value

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We examine the interactions between financing (capital structure) and investment decisions of a firm under asymmetric information about collateral (liquidation) value between well-informed managers and less-informed investors. We show that asymmetric information reduces the amount of debt issuance to finance the cost of investment, that leads to delay corporate investment. In particular, an increase in the degree of asymmetric information forces the firm to be a risk-free debt-equity financing (ultimately be the all-equity financing) by reducing the amount of debt issuance. In addition, an increase in the cash flow volatility decreases the amount of debt issuance, credit spread, and leverage under asymmetric information. Our results fit well with empirical studies. This is a joint work with Michi Nishihara.

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Profitability and investment factors in the Chinese stock returns

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Abstract

This paper evaluates the performance of the five-factor model and investigates the explanatory power of firm size, book-to-market, profitability and investment ratios in the Shanghai A-share exchange market over the January 2011 – December 2016 period. Our results do not support the findings of Fama and French (2015, 2017) and show that the five-factor model is outperformed by the three-factor model.

Keywords: Fama-French models, capital asset pricing model, Shanghai exchange market

JEL classification: G1, C5

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Quantile optimization under derivative constraint

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This talk will focus on a new type of quantile optimization problems arising from insurance contract design models. This type of optimization problems is characterized by a constraint that the derivatives of the decision quantile functions are bounded. Such a constraint essentially comes from the "incentive compatibility" constraint for any optimal insurance contract to avoid the potential severe problem of moral hazard in insurance contract design models. By a further development of the relaxation method, we provide a systemic approach to solving this new type of quantile optimization problems. The optimal quantile is expressed via the solution of a free boundary problem for a second-order nonlinear ordinary differential equation (ODE), which is similar to the Black-Scholes ODE for perpetual American options.

Summary:

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Recover Dynamic Utility from Monotonic Characteristic Processes

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In the real world, decision making under uncertainty is often viewed as an optimization problem under choice criterium, and most of theory focuses on the derivation of the "optimal decision" and its out-comes. But, poor information is available on the criterium yielding to these observed data. The interesting problem to infer the unknown criterium from the known results is an example of inverse problem. Here we are concerned with a very simple version of the problem: what does observation of the "optimal" out-put tell us about the preference, expressed in terms of expected utility; in Economics, this question was pioneered by the american economist Samuelson in1938.
Typically we try to reproduce the properties of the stochastic value function of a portfolio optimization problem in finance, which satisfies the first order condition U (t, z)). In particular, the utility process U is a strictly concave stochastic family, parametrized by a number z ∈ R + (z 7⟶ U (t, z)), and the characteristic process X c = (X t c (x)) is a non negative monotonic process with respect to its initial condition x, satisfying the martingale condition U (t, X t c (x)) is a martingale, with initial condition U (0, x) = u(x). We first introduce the adjoint process Y t (u x (x)) = U x (t, X t c (x)) which is a characteristic process for the Fenchel transform of U if and only if X t c (x)Y t (u x (x)) is a martingale. The minimal property is the martingale property of Y t (u x (x)) with the x-derivative of X t c (x), which is sufficient to reconstruct U from U x (t, x) = Y t (u x ((X t c) −1 (x))). Obviously, in general, without additional constraints, the characterization is not unique. Various example are given, in general motivated by finance or economics: contraints on a characteristic portfolio in a economy at the equilibrium, thoptimal portfolio for a in complete financial market, under strongly orthogonality between X and Y , the mixture of different economies....In any case, the results hold for general but monotonic processes, without semimartingale assumptions.

Summary:

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Representation of limit values for nonexpansive stochastic differential games

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A classical problem in ergodic control theory consists in the study of the limit behaviour of λV λ (·) as λ ↘ 0, when V λ is the value function of a deterministic or stochastic control problem with discounted cost functional with infinite time horizon and discount factor λ. We study this problem for the lower value function V λ of a stochastic differential game with recursive cost, i.e., the cost functional is defined through a backward stochastic differential equation with infinite time horizon. But unlike the ergodic control approach, we are interested in the case where the limit can be a function depending on the initial condition. For this we extend the so-called non-expansivity assumption from the case of control problems to that of stochastic differential games.
Based on a joint work with Rainer Buckdahn (Brest, France), Nana Zhao (Weihai, China).

Summary:

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Some existence and uniqueness results for obliquely reflected BSDEs

Adrien Richou[1] ; Jean-François Chassagneux[2]

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In this talk, we present some recent results on obliquely reflected BSDEs. In particular we are able to deal with assumptions on the generator weaker than in currently known results. An existence and uniqueness result is obtained in a non Markovian framework by assuming some regularity on the terminal condition. Moreover, a general existence result is obtained in the Markovian framework. We also present an application to some new optimal switching problems called randomised switching problems.
This is a joint work with Jean-François Chassagneux (University of Paris 7)

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Some sequential problems for Brownian motion with random drift in statistics and finance.

Auteur(s) contact: albertsh@mi.ras.ru

We consider two models of observable process X = (X t):
Model A: X t = μt + B t ,
Model B: X t = μt + ν(t − θ)^ + + B t ,
where B = (B t) is a standard Brownian motion, μ and ν are unknown parameters, and θ is a disorder time.
For Model A, we consider some sequential statistical problems with different risk functions.
For Model B, we deal with sequential problems of the following type:
H 1 = sup EX τ
or H 2 = sup EE(X τ),
τ ≤1
τ ≤1
where τ is a stopping time. We show that for such functionals H 1 and H 2 optimal stopping times have the following form:
τ ∗ = inf{t ≤ 1: ψ(t) ≥ a ∗ (t)},
where ψ(t) is some statistic of observations and a ∗ (t) is a curvilinear boundary satisfying the Fredholm integral equation of second order. These problems will be applied to the real asset price models (Apple, Nasdaq).
The talk will gives a survey of the joint papers of authors with Četin, Novikov, Zhitlukhin, and Muravlev.

Summary:

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Stochastic Stefan-type Problems and Order Book Dynamics

Marvin Mueller[1]

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Moving boundary problems allow to model macroscopic systems with phase transition at an inner boundary. Motivated by problems in economics and finance, more explicitely price-time continuous modelling of the limit order book, we consider a stochastic and non-linear extension of the classical Stefan-problem in one space dimension. More precisely, the dynamics on buy and sell side in an electronic financial markets are modeled by respective second order stochastic partial differential equations which are separated by an inner interface: the mid-price. We discuss new results beyond existence theory, such as approximations of the solution.

Summary:

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Stochastic control under periodic observation times

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We consider a version of the stochastic control problem, in which control opportunities arrive only at the jump times of an independent Poisson process. We consider perpetual American options, optimal dividend problems, and inventory control problems, driven by a spectrally one-sided Levy process. In particular, we show that barrier-type strategies are optimal under suitable conditions. The optimal strategies and value functions are concisely written in terms of the scale functions. This talk is based on the joint work with A. Bensoussan and J.L. Perez.

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The Neumann Boundary Problem for Elliptic Partial Differential Equations with Nonlinear Divergence Terms

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We prove the existence and uniqueness of weak solution of a Neumann boundary problem for an elliptic partial differential equation (PDE for short) with a singular divergence term which can only be understood in a weak sense. A probabilistic approach is applied by studying the backward stochastic differential equation (BSDE for short) corresponding to the PDE.

Summary:

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The Skorokhod embedding problem and single jump martingales: a connection via change of time

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Let $\overline{N}_t = \sup_{s \le t} N_s$ be a running maximum of a local martingale N. We assume that N is max-continuous, i.e. $\overline{N}$ is continuous. The Skorokhod embedding problem corresponds to a special case where N is a Brownian motion stopped at a finite stopping time τ. Consider the change of time

generated by the running maximum:
$\sigma_t := \inf\{s\colon \overline{N}_s > t\}$.
Then the time-changed process $M := N \circ \sigma$ has a simple structure:
$M_t = N_{\sigma_t} = t \wedge W - V1_{\{t \geq W\}}$,
where $W := \overline{N}_\infty$ and $V := \overline{N}_\infty - N_\infty$ (V is correctly defined on the set $\{\overline{N}_\infty < \infty\}$). Besides, $M_\infty = N_\infty$ and $\overline{M}_\infty = \overline{N}_\infty$. This simple observation explains how we can use single jump martingales M of the above form to describe properties of N. For example, N is a closed supermartingale if and only M is a martingale and the negative part of $W - V$ is integrable. Another example shows how to connect the Dubins-Gilat construction of a martingale whose supremum is given by the Hardy-Littlewood maximal function and the Azéma-Yor construction in the Skorokhod embedding problem.

Summary:

We establish a connection between the sets of possible joint distributions of pairs $(N_\infty, \overline{N}_\infty)$ for different subclases of max-continuous local martingales N, in particular, for N corresponding to the Skorokhod embedding problem.

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The asymptotic expansion of the regular discretization error of Itô integrals

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We study a Edgeworth-type refinement of the central limit theorem for the discretizacion error of Itô integrals. Towards this end, we introduce a new approach, based on the anticipating I Itô formula. This alternative technique allows us to compute explicitly the terms of the corresponding expansion formula. A joint work with E. Alos.

Summary:

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Utility maximization for Lévy switching models

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This article is devoted to the maximization of HARA utilities of Lévy switching process on finite time interval via dual method. We give the description of all f-divergence minimal martingale measures in progressively enlarged filtration, the expression of their Radon-Nikodym densities involving Hellinger and Kulback-Leibler processes, the expressions of the optimal strategies for the maximization of HARA utilities as well as the values of the corresponding maximal expected utilities. The example of Brownian switching models is presented.

This is common work with Lioudmila Vostrikova.

Summary: