13th International Workshop on Stochastic Models and Control

March 14–18, 2022, Lübeck-Travemünde, Germany

Sponsors

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About

SMC

The workshop on Stochastic Models and Control (SMC) 2022 in Lübeck-Travemünde is the 13th edition in the series of these conferences. At SMC, experts from different fields of stochastic control and optimization meet to exchange ideas and to discuss recent developments. The workshop aims to connect theory with applications which can be found in various areas like stochastic networks, game theory, statistics, operations research, finance and insurance, energy economics, molecular dynamics, robotics, communication technology. The goal is to foster existing collaborations and to identify and explore directions for future research.

Program committee

Nicole Bäuerle (Karlsruhe Institute of Technology)
Giorgio Ferrari (University of Bielefeld)
Jörn Sass (University of Kaiserslautern)
Sören Christensen (University of Kiel)
Jan Kallsen (University of Kiel)
Ralf Wunderlich (BTU Cottbus-Senftenberg)

Local Organizers & Contact Information

e-mail for all questions: smc2022@math.uni-kiel.de

Sören Christensen	+49 431 880 3690
Marie-Christine Ceulemans (at CAU Kiel)	+49 431 880 3646
Theodor-Schwartz house	+49 4502 86 220

Timetable

CT: Contributed Talk, IS: Invited Speaker, ISO: Invited Speaker online.

Monday, March 14

15:00–15:45	**Registration & Coffee**		
15:45–16:00	**Welcome remarks**		
16:00–16:45	IS	**Łukasz Stettner** Warsaw, Poland	Discrete time risk sensitive portfolio optimization with transaction costs: discounted and span contraction approaches
16:45–17:10	CT	**Florian Aichinger** Linz, Austria	Utility maximization in multivariate Volterra Models
17:10–17:35	CT	**Laura Körber** Berlin, Germany	Merton's optimal investment problem with jump signals
17:35–18:00	CT	**Shihao Zhu** Bielefeld, Germany	Optimal Dividends under Markov-Modulated Bankruptcy Level

Link to abstracts:

Tuesday, March 15

08:30–09:15	IS	**Claudia Strauch** Aarhus, Denmark	Nonparametric approaches to data-driven stochastic control
09:15–09:40	CT	**Jodi Dianetti** Bielefeld, Germany	Multidimensional singular control and related Skorokhod problem: sufficient conditions for the characterization of optimal controls
09:40–10:05	CT	**Felix Dammann** Bielefeld, Germany	Optimal Execution under Multiplicative Price Impact and Incomplete Information on the Return
10:05–10:30	CT	**Mogens Steffensen** Copenhagen, Denmark	Optimal Investment with Uncertain Risk Aversion
10:30–11:00	**Coffee**		
11:00–11:45	ISO	**Fred Benth** Oslo, Norway	Pricing options on flow forwards by neural networks in Hilbert space
11:45–12:10	CT	**Christoph Belak** Berlin, Germany	Convergence of Deep Solvers for Semilinear PDEs
12:10–12:35	CT	**Martin Redmann** Halle-Wittenberg, Germany	Low-dimensional approximations of high-dimensional asset price models
12:35–14:15	**Lunch**		
14:15–15:00	ISO	**Dylan Possamaï** Zürich, Switzerland	Non-asymptotic convergence rates for mean-field games: weak formulation and McKean–Vlasov BSDEs
15:00–15:25	CT	**Matteo Burzoni** Milan, Italy	Mean field games with absorption and common noise with a model of bank run
15:25–15:50	CT	**Berenice Neumann** Trier, Germany	Finite State Mean Field Games with Common Shocks
15:50–16:20	**Coffee**		
16:20–17:05	IS	**François Dufour** Bordeaux, France	Stationary Markov Nash equilibria for nonzero-sum constrained ARAT Markov games
17:05–17:30	CT	**Edward Korveh** Ghana	Dynamic mean-variance asset allocation with Hawkes term structure
17:30–17:55	CT	**Christian Laudagé** Linz, Austria	Scalarized utility-based multi-asset risk measures

Link to abstracts:

Wednesday, March 16

08:30–09:15	IS	**Christa Cuchiero** Wien, Austria	Optimal bailout strategies resulting from the drift controlled supercooled Stefan problem
09:15–09:40	CT	**Han Cheng Lie** Potsdam, Germany	Convexity in first exit optimal control problems with SDE constraints
09:40–10:05	CT	**Rhoss Beauneur Likibi Pellat** Ghana	Differentiability for a class of quadratic backward SDEs
10:05–10:30	CT	**Max Nendel** Bielefeld, Germany	Wasserstein perturbations of Markovian transition semigroups
10:30–11:00	**Coffee**		
11:00–11:45	ISO	**Sara Biagini** Rom, Italy	Optimal dynamic regulation of carbon emissions market: a variational approach
11:45–12:10	CT	**E. Emanuel Rapsch** Berlin, Germany	On Controlled Stopping Games and Transitional Climate Risk
12:10–12:35	CT	**Ricarda Rosemann** Kaiserslautern, Germany	Regulation of Emission Trading Systems: A Stochastic Control Model
12:35–13:00	CT	**Peter Schaumann** Ulm, Germany	Robust DC Optimal Power Flow with Modeling of Solar Power Supply Uncertainty via R-Vine Copulas
13:00–14:00	**Lunch**		
afternoon	**Excursion to Lübeck**		

- We will be picked up by a bus at 14:00 at the parking lot of the Theodor Schwartz House and brought to Lübeck to the Music and Congress Hall (MUK).
- There, at 14:30, three guided tours are waiting for us, two in English and one in German.
- After the guided tour we all have some free time. Since there will be no dinner at the Theodor Schwartz House on Wednesday, everyone should provide themselves with something to eat.
- At 19:00 the bus will return from the MUK. Please be on time.

Link to abstracts:

Thursday, March 17

08:30–09:15	ISO	**Anna Jaśkiewicz** Wrocław, Poland	Constrained discounted stochastic games
09:15–09:40	CT	**Andi Rares Bodnariu** Stockholm, Sweden	Local time pushed mixed stopping times and a smooth fit principle for time-inconsistent stopping problems
09:40–10:05	CT	**Josef Strini** Graz, Austria	A dividend problem with a constraint on the ruin time: the time-inconsistent view
10:05–10:30	CT	**Maike Klein** Kiel, Germany	On the gain of collaboration
10:30–11:00	**Coffee**		
11:00–11:45	ISO	**Erik Ekström** Uppsala, Sweden	Stopping games with uncertain competition
11:45–12:10	CT	**Andrea Bovo** Leeds, UK	Variational inequalities on unbounded domains for zero-sum singular-controller vs. stopper games
12:10–12:35	CT	**Tamara Göll** Karlsruhe, Germany	Nash equilibria for relative investors via no-arbitrage arguments
12:35–14:00	**Lunch**		
14:00–14:45	IS	**Zbigniew Palmowski** Wrocław, Poland	Double continuation regions for American options
14:45–15:10	CT	**Simon Fischer** Kiel,Germany	Limit Behavior for Optimal Stopping Problems with Finite Time Horizon
15:10–15:35	CT	**Damian Jelito** Kraków, Poland	Risk-sensitive optimal stopping with an unbounded terminal cost function
15:35–16:00	CT	**Yuqiong Wang** Uppsala, Sweden	Stopping problems with an unknown state
16:00–16:30	**Coffee**		
16:30–17:15	IS	**Sigrid Källblad** Stockholm, Sweden	Controlled measure-valued martingales: a viscosity solution approach
17:15–17:40	CT	**Leonie Brinker** Köln, Germany	Optimal stochastic control of a path-dependent risk indicator for insurance companies
17:40–18:05	CT	**Claudia Ceci** Chieti-Pescara, Italy	Optimal reinsurance and risk measures in a partially observable contagion model

Link to abstracts:

Friday, March 18

09:00–09:25	CT	**Sascha Desmettre** Linz, Austria	Dynamic Surplus Optimization with Performance- and Index-Linked Liabilities
09:25–09:50	CT	**Simon Pojer** Graz, Austria	Numerical Approximation of Gerber-Shiu Functions in a Markovian Shot-Noise Model
09:50–10:15	CT	**Paul Honore Takam** Cottbus-Senftenberg, Germany	Stochastic Optimal Control of Thermal Energy Storages
10:15–10:45	**Coffee**		
10:45–11:10	CT	**Ralf Wunderlich** Cottbus-Senftenberg, Germany	Stochastic Epidemic Models with Partial Information and Dark Figure Estimation
11:10–11:55	ISO	**Huyên PHAM** Paris, France	Optimal bidding strategies for targeted advertising

Link to abstracts:

List of Abstracts – Talks

Monday, March 14

Discrete-time risk sensitive portfolio optimization with proportional transaction costs

Łukasz Stettner IS

Polish Academy of Sciences, Warsaw

In the talk we consider a discrete-time risk sensitive portfolio optimization over a long time horizon with proportional transaction costs. We show that within the log-return i.i.d. framework the solution to a suitable Bellman equation exists under minimal assumptions and can be used to characterize the optimal strategies for both risk-averse and risk-seeking cases. In the first part of the paper we use a suitable vanishing discount approach and convexity arguments and obtain stationary Bellman equation in the risk seeking case and nonstationary in the risk sensitive case. To get stationary Bellman equation in the risk sensitive case we need extra (not very restrictive) assumptions. Moreover, using numerical examples, we show how a Bellman equation analysis can be used to construct or refine optimal trading strategies in the presence of transaction costs. The presentation is based on a joint paper with M. Pitera from Jagiellonian University in Cracow.

Utility maximization in multivariate Volterra Models

Florian Aichinger

University of Linz, Austria

This talk is concerned with portfolio selection for an investor with power utility in multi-asset financial markets in a rough stochastic environment. We investigate Merton's portfolio problem for different multivariate Volterra models, covering the rough Heston model. First we consider a class of multivariate affine Volterra models introduced in [E. Abi Jaber et al., SIAM J. Financial Math., 12, 369–409, (2021)]. Based on the classical Wishart model described in [N. Bäuerle and Li, Z., J. Appl. Probab., 50, 1025–1043 (2013)], we then introduce a new matrix-valued stochastic volatility model, where the volatility is driven by a Volterra-Wishart process. Due to the non-Markovianity of the underlying processes, the classical stochastic control approach cannot be applied in these settings. To overcome this issue, we provide a verification argument using calculus of convolutions and resolvents. The resulting optimal strategy can then be expressed explicitly in terms of the solution of a multivariate Riccati-Volterra equation. We thus extend the results obtained by Han and Wong to the multivariate case, avoiding restrictions on the correlation structure linked to the martingale distortion transformation used in [B. Han and Wong, H. Y., Finance Res. Lett., 39 (2021)]. We also provide existence and uniqueness theorems for the occurring Volterra processes and illustrate our results with a numerical study. Comments : This paper ist joint work with Sascha Desmettre (JKU Linz); The preprint is available on arXiv: `https://arxiv.org/abs/2111.02191`

Merton's optimal investment problem with jump signals

Laura Körber

TU Berlin, Germany

We analyse a new framework of stochastic control which uses the theory of Meyer σ-fields to allow for more flexibility in the information structure. As an illustration, we look at Merton's optimal investment problem where we add a noisy signal that possibly warns the investor about impending jumps in the stock. By means of dynamic programming, we solve the problem explicitly and determine the investor's optimal strategy in dependence of the arriving jump signal. In a case study with Gaussian jumps, we find, for instance, that an investor may prefer to disinvest completely even after a mildly positive signal. Our setting allows us also to address questions such as whether it is better to improve signal quality or quantity and how much extra value can be generated from either choice. This talk is based on joint work with Peter Bank (TU Berlin). Comments : The corresponding preprint can be found on arXiv: 2109.13787.

Optimal Dividends under Markov-Modulated Bankruptcy Level

Shihao Zhu

University of Bielefeld, Germany

This paper proposes and solves an optimal dividend problem in which a two-state regime-switching environment affects the dynamics of the company's cash surplus and, as a novel feature, also the bankruptcy level. The aim is to maximize the total expected profits from dividends until bankruptcy. The company's optimal dividend payout is therefore influenced by four factors simultaneously: Brownian fluctuations in the cash surplus, as well as regime changes in drift, volatility and bankruptcy levels. In particular, the average profitability can assume different signs in the two regimes. We find a rich structure of the optimal strategy, which, depending on the interaction of the model's parameters, is either of barrier-type or of liquidation-barrier type. Furthermore, we provide explicit expressions of the optimal policies and value functions. Finally, we complement our theoretical results by a detailed numerical study, where also a thorough analysis of the sensitivities of the optimal dividend policy with respect to the problem's parameters is performed.

Tuesday, March 15

Nonparametric approaches to data-driven stochastic control

Claudia Strauch IS

University of Aarhus, Denmark

One of the fundamental assumptions in stochastic control of continuous-time processes is that the dynamics of the underlying process are known. This is, however, usually obviously not fulfilled in practice. On the other hand, a rich theory for nonparametric estimation of the characteristics of continuous-time processes has been developed over the last decades. In this talk, we discuss how to bring together these two areas for developing purely data-driven strategies for stochastic control, which we explore for ergodic singular control problems associated to continuous diffusions and Lévy processes.

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

Jodi Dianetti

University of Bielefeld, Germany

We characterize the optimal control for a class of singular stochastic control problems as the unique solution to a related Skorokhod reflection problem. The considered optimization problems concern the minimization of a discounted cost functional over an infinite time-horizon through a process of bounded variation affecting an Itô-diffusion. The setting is multidimensional, the dynamics of the state and the costs are convex, the volatility matrix can be constant or linear in the state. We prove that the optimal control acts only when the underlying diffusion attempts to exit the so-called waiting region, and that the direction of this action is prescribed by the derivative of the value function. Our approach is based on the study of a suitable monotonicity property of the derivative of the value function through its interpretation as the value of an optimal stopping game. Such a monotonicity allows to construct nearly optimal policies which reflect the underlying diffusion at the boundary of approximating waiting regions. The limit of this approximation scheme then provides the desired characterization. Our result applies to a relevant class of linear-quadratic models, among others. Furthermore, it allows to construct the optimal control in degenerate and non degenerate settings considered in the literature, where this important aspect was only partially addressed.

Optimal Execution under Multiplicative Price Impact and Incomplete Information on the Return

Felix Dammann

University of Bielefeld, Germany

We study an optimal liquidation problem with multiplicative price impact in which the trend of the asset's price is an unobservable Bernoulli random variable. The investor aims at selling over an infinite time-horizon a fixed amount of assets in order to maximize a net expected profit functional, and lump-sum as well as singularly continuous actions are allowed. Our mathematical modelling leads to a singular stochastic control problem featuring a finite-fuel constraint and partial observation. We provide the complete analysis of an equivalent three-dimensional degenerate problem under full information, whose state process is composed of the asset's price dynamics, the amount of available assets in the portfolio, and the investor's belief about the true value of the asset's trend. The optimal execution rule and the problem's value function are expressed in terms of the solution to a truly two-dimensional optimal stopping problem, whose associated belief-dependent free boundary b triggers the investor's optimal selling rule. The curve b is uniquely determined through a nonlinear integral equation, for which we derive a numerical solution allowing to understand the sensitivity of the problem's solution with respect to the relevant model's parameters. This talk is based on joint work with Giorgio Ferrari.

Optimal Investment with Uncertain Risk Aversion

Mogens Steffensen

Universiy of Copenhagen, Denmark

We solve the problem of an investor who maximizes utility but is uncertain about preferences. We propose a problem formulation based on expected certainty equivalents. We tackle the time-consistency issues arising from that formulation by applying the equilibrium theory approach. To this end, we provide the proper definitions and prove a rigorous verification theorem. We complete the calculations for the cases of power and exponential utility. For power utility, we illustrate in a numerical example, that the optimal stock proportion is independent of wealth, but decreasing in time, which we also supplement by a theoretical discussion. For exponential utility, the usual constant absolute risk aversion is replaced by its expectation. Comments : If I am given the opportunity to talk, that should be scheduled for Monday or Tuesday, as I have to leave the workshop for teaching duties in Copenhagen no later than Wednesday.

Pricing options on flow forwards by neural networks in Hilbert space

Fred Benth ISO

University of Oslo, Norway

We propose a methodology for pricing options on flow forwards by applying infinite-dimensional neural networks. We recast the option pricing problem as an optimization problem in a Hilbert space of real-valued function on the positive real line, which is the state space for the forward price term structure dynamics. This optimization problem is solved by facilitating a feedforward neural network architecture designed for approximating continuous functions on the state space. The proposed neural net is built upon the basis functions of the Hilbert space. We present a case study showing numerical efficiency of the approach, with an improved performance over classical neural net trained on discretely sampling the term structure curves.

This is joint work with Nils Detering (University of California at Santa Barbara) and Luca Galimberti (Norwegian University of Science and Technology)

Convergence of Deep Solvers for Semilinear PDEs

Christoph Belak

TU Berlin, Germany

We derive convergence rates for a deep learning algorithm for semilinear partial differential equations which is based on a Feynman-Kac representation in terms of an uncoupled forward-backward stochastic differential equation and a discretization in time of the stochastic equation. We show that the error of the deep learning algorithm is bounded in terms of its loss functional, hence yielding a direct measure to judge the quality of the deep solver in numerical applications, and that the loss functional converges sufficiently fast to zero to guarantee that the error of the deep learning algorithm vanishes in the limit. As a consequence of these results, we argue that the deep solver has a strong convergence rate of order 1/2. The talk is based on joint work with Oliver Hager, Lotte Schnell, Charlotte Reimers (TU Berlin) and Maximilian Würschmidt (Trier University).

Low-dimensional approximations of high-dimensional asset price models

Martin Redmann

University of Halle-Wittenberg, Germany

We consider high-dimensional asset price models that are reduced in their dimension in order to reduce the complexity of the problem or the effect of the curse of dimensionality in the context of option pricing. We apply model order reduction (MOR) to obtain a reduced system. MOR has been previously studied for asymptotically stable controlled stochastic systems with zero initial conditions. However, stochastic differential equations modeling price processes are uncontrolled, have non-zero initial states and are often unstable. Therefore, we extend MOR schemes and combine ideas of techniques known for deterministic systems. This leads to a method providing a good pathwise approximation. After explaining the reduction procedure, the error of the approximation is analyzed and the performance of the algorithm is shown conducting several numerical experiments.

Non-asymptotic convergence rates for mean-field games: weak formulation and McKean–Vlasov BSDEs

Dylan Possamaï ISO

ETH Zürich, Switzerland

This work is mainly concerned with the so-called limit theory for mean-field games. Adopting the weak formulation paradigm put forward by Carmona and Lacker, we consider a fully non-Markovian setting allowing for drift control, and interactions through the joint distribution of players' states and controls. We provide first a new characterisation of mean-field equilibria as arising from solutions to a novel kind of McKean–Vlasov back- ward stochastic differential equations, for which we provide a well-posedness theory. We incidentally obtain there unusual existence and uniqueness results for mean-field equilibria, which do not require short-time horizon, separability assumptions on the coefficients, nor Lasry and Lions's monotonicity conditions, but rather smallness conditions on the terminal reward. We then take advantage of this characterisation to provide non-asymptotic rates of convergence for the value functions and the Nash-equilibria of the N-player version to their mean-field counterparts, for general open-loop equilibria. This relies on new back- ward propagation of chaos results, which are of independent interest. This is a joint work with Ludovic Tangpi.

Mean field games with absorption and common noise with a model of bank run

Matteo Burzoni

University of Milan, Italy

We consider a mean field game describing the limit of a stochastic differential game of N-players whose state dynamics are subject to idiosyncratic and common noise and that can be absorbed when they hit a prescribed region of the state space. We provide a general result for the existence of weak mean field equilibria which, due to the absorption and the common noise, are given by random flow of sub-probabilities. We first use a fixed point argument to find solutions to the mean field problem in a reduced setting resulting from a discretization procedure and then we prove convergence of such equilibria to the desired solution. We exploit these ideas also to construct ϵ-Nash equilibria for the N-player game. Since the approximation is two-fold, one given by the mean field limit and one given by the discretization, some suitable convergence results are needed. We also introduce and discuss a novel model of bank run that can be studied within this framework.

Finite State Mean Field Games with Common Shocks

Berenice Neumann

University of Trier, Germany

We present a new framework for mean field games with finite state space and common noise, where the common noise is given through shocks that occur at random times. We first analyse the game for up to n shock times in which case we are able to characterize mean field equilibria through a family of parametrized and coupled forward-backward systems and prove existence of solutions to these systems for a small time horizon. Thereafter, we show that for the case of an unbounded number of shocks the equilibria of the game restricted to n shocks are approximate mean field equilibria. The talk is based on joint work with Frank Seifried.

Stationary Markov Nash equilibria for nonzero-sum constrained ARAT Markov games

François Dufour

IS

University of Bordeaux, France

We consider a nonzero-sum Markov game on an abstract measurable state space with compact metric action spaces. The goal of each player is to maximize his respective discounted payoff function under the condition that some constraints on a discounted payoff are satisfied. We are interested in the existence of a Nash or noncooperative equilibrium. Under suitable conditions, which include absolute continuity of the transitions with respect to some reference probability measure, additivity of the payoffs and the transition probabilities (ARAT condition), and continuity in action of the payoff functions and the density function of the transitions of the system, we establish the existence of a constrained stationary Markov Nash equilibrium, that is, the existence of stationary Markov strategies for each of the players yielding an optimal profile within the class of all history-dependent profiles.

Dynamic mean-variance asset allo cation with Hawkes term structure

Edward Korveh

AIMS Ghana

In this talk, we present a sufficient maximum principle for a stochastic optimal control problem, where the state processes are governed by continuous time Hawkes jump diffusion models. The result is then applied to solve a dynamic mean-variance asset allocation problem in a financial market where both the stochastic interest rate and the risky asset are modelled by Hawkes jump diffusion processes. Furthermore, we investigate a special case of the dynamic mean-variance asset allocation problem when the Hawkes jump only entered the risky asset via the interest rate. Key words: Stochastic maximum principle, Hawkes process, Mean-variance, Asset allocation, Contagion NB: This is a joint work with Olivier Menoukeu Pamen and Xin Zhang.

Scalarized utility-based multi-asset risk measures

Christian Laudagé

University of Linz, Austria

Financial institutions have to satisfy capital adequacy tests required, e.g., by the Basel Accords for banks or Solvency II for insurers. At the same time, they would like to maximize their expected utility. Combining both aspects leads to a portfolio optimization problem under a risk constraint. In this talk, we give an example of a tight financial situation in which no reallocation of the initial endowment exists such that the capital adequacy test is passed. The classical portfolio optimization approach breaks down and a capital increase is needed. We introduce the scalarized utility-based multi-asset (SUBMA) risk measure, which optimizes the hedging costs and the expected utility of an agent simultaneously subject to the capital adequacy test. We find out that the SUBMA risk measure is coherent if the utility function has constant relative risk aversion and the capital adequacy test leads to a coherent acceptance set. In a one-period financial market model we present a sufficient condition for the SUBMA risk measure to be finite-valued and continuous. Under further assumptions on the utility function we obtain existence and uniqueness results for the optimal hedging strategies. Finally, we calculate the SUBMA risk measure in a continuous-time financial market model for two benchmark capital adequacy tests. Comments: The corresponding paper is joint work with S. Desmettre (Johannes Kepler University Linz) and J. Sass (Technische Universität Kaiserslautern) and is available under SSRN: https://ssrn.com/abstract=3924271

Wednesday, March 16

Optimal bailout strategies resulting from the drift controlled supercooled Stefan problem

Christa Cuchiero IS

University of Vienna, Austria

We consider the problem faced by a central bank which bails out distressed financial institutions that pose systemic risk to the banking sector. In a structural default model with mutual obligations, the central agent seeks to inject a minimum amount of cash to a subset of the entities in order to limit defaults to a given proportion of entities. We prove that the value of the agent's control problem converges as the number of defaultable agents goes to infinity, and that it satisfies a drift controlled version of the supercooled Stefan problem. We compute optimal strategies in feedback form by solving numerically a forward-backward coupled system of PDEs. Our simulations show that the agent's optimal strategy is to subsidise banks whose asset values lie in a non-trivial time-dependent region. Finally, we study a linear-quadratic version of the model where instead of the terminal losses, the agent optimises a terminal cost function of the equity values. In this case, we are able to give semi-analytic strategies, which we again illustrate numerically. The talk is based on joint work with Christoph Reisinger and Stefan Rigger.

Convexity in first exit optimal control problems with SDE constraints

Han Cheng Lie

University of Potsdam, Germany

We consider a class of SDE-constrained stochastic optimal control problems that are motivated by elliptic PDE boundary value problems on bounded domains. In this class, the control appears in the SDE constraint only as a change of drift term. The objective functional that we seek to minimise consists in two terms: the first term is the Kullback-Leibler divergence of the law of the perturbed SDE with respect to the law of the original SDE, where both laws are restricted to the sigma-algebra associated to the first exit time from the bounded domain; and the second term is the expectation of a path functional that does not depend on the control and takes as input the trajectory of the perturbed SDE up to the first exit time. We calculate the Frechet derivatives of each term with respect to the control. Using a simple example, we show that the Kullback-Leibler divergence term is in general not a convex function of the control. On the other hand, we show that if the path functional in the second term in the objective is uniformly bounded from below, then this suffices for strict convexity of the objective functional.

Differentiability for a class of quadratic backward SDEs

Rhoss Beauneur Likibi Pellat

AIMS Ghana

In this talk, we study the well-posedness and the differentiability of a class of BSDEs with quadratic drivers. The analysis of the differentiability is done via additional assumption on the derivatives of both the driver and the terminal condition. As an application, we extend these classical and Malliavin smoothness results in the Markovian setting i.e., the randomness force is now driven by a process which is solution to an SDE with a drift satisfying some weak conditions. As a by-product, we obtain a rate of convergence of some numerical approximation of solutions to such BSDEs.

Wasserstein perturbations of Markovian transition semigroups

Max Nendel

University of Bielefeld, Germany

We deal with a class of time-homogeneous continuous-time Markov processes with transition probabilities bearing a nonparametric uncertainty. The uncertainty is modeled by considering perturbations of the transition probabilities within a proximity in Wasserstein distance. As a limit over progressively finer time periods, on which the level of uncertainty scales proportionally, we obtain a convex semigroup, which solves a Hamilton-Jacobi-Bellman equation in a viscosity sense. As a consequence, in standard situations, the nonlinear transition operators arising from Wasserstein uncertainty coincide with the value function of an optimal control problem. We additionally provide sensitivity bounds for the convex semigroup relative to the reference model. The talk is based on joint work with Michael Kupper and Sven Fuhrmann.

Robust portfolio choice with sticky wages

Sara Biagini **ISO**

LUISS G. Carli Rome, Italy

We present a robust version of the life-cycle optimal portfolio choice prob- lem in the presence of labor income, as introduced in Biffis, Gozzi and Pros- docimi [7] and Dybvig and Liu In particular, in [7] the influence of past wages on the future ones is modeled linearly in the evolution equation of la- bor income, through a given weight function. The optimisation relies on the resolution of an infinite dimensional HJB equation. We improve the state of art in three ways. First, we allow the weight to be a Radon measure. This accommodates for more realistic weighting of the sticky wages, like e.g. on a discrete temporal grid according to some periodic income. Second, there is a general correlation structure between labor income and stocks market. This naturally affects the optimal hedging demand, which may increase or decrease according to the correlation sign. Third, we allow the weight to change with time, possibly lacking perfect identification. The uncertainty is specified by a given set of Radon measures K, in which the weight process takes values. This renders the inevitable uncertainty on how the past affects the future, and includes the standard case of error bounds on a specific estimate for the weight. Under uncertainty averse preferences, the decision maker takes a maxmin approach to the problem. Our analysis confirms the intuition: in the infinite dimensional setting, the optimal policy remains the best investment strategy under the worst case weight. This is joint work with Fausto Gozzi and Margherita Zanella.

On Controlled Stopping Games and Transitional Climate Risk

E. Emanuel Rapsch

TU Berlin, Germany

We study the Nash system of a (non-necessarily homogeneous) n-player game of optimal stopping in the presence of common strongly Markovian noise. For linear diffusions, we derive a one-to-one characterisation of subgame-perfect feedback Nash equilibria in terms of this coupled free-boundary type system of differential equations, whence a method of constructing these equilibria and devising conditions on both their existence and number. If the game's rules can be controlled by a principal through a decision at its beginning, the decision problem of choosing between different regimes of equilibria can be mathematically addressed. A major motivation for this work stems from the challenge of technological transition in environments of strategic market interaction under a commonly faced uncertainty. A key example is the transition to low-carbon technology in the presence of shifting consumer sentiment, for instance in the automotive sector. With this research, we aim at addressing the topics of firm valuation, investment timing and policy choice in this specific context. This project is ongoing doctoral research supervised by Christoph Belak.

Regulation of Emission Trading Systems: A Stochastic Control Model

Ricarda Rosemann

TU Kaiserslautern, Germany

Emission trading systems (ETS) represent a widely used instrument to control greenhouse gas emissions while minimizing reduction costs. In an ETS the desired amount of emissions in a predefined time period is fixed in advance; corresponding to this amount, allowances for one ton of greenhouse gas emissions are handed out or auctioned to companies which underlie the system. Companies may trade allowances so that, ideally, emissions are reduced where this can be done at lowest costs. If emissions occur which are not covered by an allowance, they are subject to a penalty at the end of the time period. Emissions depend on non-deterministic parameters such as weather and the state of the economy. Therefore, it is natural to view emissions as a stochastic quantity. This introduces a challenge for the companies involved: In planning their abatement actions, they need to avoid penalty payments without knowing their total amount of emissions. We consider a stochastic control approach to address this problem: In a continuous model, we use the rate of emission abatement as a control in minimizing the costs that arise from penalty payments and abatement costs. In a simplified version of this model the resulting Hamilton-Jacobi-Bellman equation can be solved analytically. Taking the viewpoint of a regulator of an ETS, our main interest is to determine the resulting emissions and to evaluate their compliance with the given emission target. This quantity is not directly given by the solution to the stochastic control problem. Instead we need to solve an SDE, where the abatement rate enters as the drift term. Due to the nature of the penalty function the abatement rate is not continuous. This means that classical results on existence and uniqueness of a solution as well as convergence of numerical methods do not apply. Therefore we prove similar results under assumptions suitable for our case. We extend the model by considering several consecutive time periods. This enables us to model the transfer of unused allowances to the subsequent time period. In formulating the multi-period model we pursue two different approaches: In the first we assume the value that the company anticipates for an unused allowance to be constant throughout one time period. In this case we may proceed similarly to the one-period model and again obtain an analytical solution for a simplified version of the model. In the second approach we introduce an additional random variable to simulate the evolution of the anticipated price for an unused allowance. This adds another dimension to the value function and thus leads to a more demanding control problem. Our results indicate that under realistic settings the probability of non-compliance with the emission target is considerably large. It can be reduced for instance by an increase of the penalty. In the multi-period model we observe that by allowing the transfer of allowances to the subsequent time period, the probability of non-compliance decreases remarkably. Comments : Joint work with Jörn Sass

Robust DC Optimal Power Flow with Modeling of Solar Power Supply Uncertainty via R-Vine Copulas

Peter Schaumann

University of Ulm, Germany

We present a robust approximation of joint chance constrained DC Optimal Power Flow in combination with a model-based prediction of uncertain power supply via R-vine copulas. It is applied to optimize the discrete curtailment of solar feed-in in an electrical distribution network and guarantees network stability under fluctuating feed-in. This is modeled by a two-stage mixed-integer stochastic optimization problem proposed by Aigner et al. (European Journal of Operational Research, (2021)). The solution approach is based on the approximation of chance constraints via robust constraints using suitable uncertainty sets. The resulting robust optimization problem has a known equivalent tractable reformulation.To compute uncertainty sets that lead to an inner approximation of the stochastic problem, an R-vine copula model is fitted to the distribution of the multi-dimensional power forecast error, i.e., the difference between the forecasted solar power and the measured feed-in at several network nodes. The uncertainty sets are determined by encompassing a sufficient number of samples drawn from the R-vine copula model. Furthermore, an enhanced algorithm is proposed to fit R-vine copulas which can be used to draw conditional samples for given solar radiation forecasts. The experimental results obtained for real-world weather and network data demonstrate the effectiveness of the combination of stochastic programming and model-based prediction of uncertainty via copulas. We improve the outcomes of previous work by showing that the resulting uncertainty sets are much smaller and lead to less conservative solutions while maintaining the same probabilistic guarantees. Authors : Kevin-Martin Aigner, Peter Schaumann, Freimut von Loeper, Alexander Martin, Volker Schmidt, Frauke Liers

Thursday, March 17

Constrained discounted stochastic games

Anna Jaśkiewicz ISO

Wroclaw University of Science and Technology, Poland

In this talk, I will introduce a large class of constrained non-cooperative stochastic Markov games with countable state spaces and discounted cost criteria. In one-player case, i.e., constrained discounted Markov decision models, it is possible to formulate a static optimisation problem whose solution determines a stationary optimal strategy (or policy) in the dynamical infinite horizon model. This solution lies in the compact convex set of all occupation measures induced by strategies, defined on the set of state-action pairs. In case of n-person discounted games the occupation measures are induced by strategies of all players. Therefore, it is difficult to generalise the approach directly. The objective of the talk is to show how to overcome this difficulty by defining a constrained non-cooperative static game whose Nash equilibrium induces a stationary Nash equilibrium in the Markov game. This is done for games with bounded cost functions and positive initial state distribution. An extension to a class of Markov games with unbounded costs and arbitrary initial state distribution relies on approximation of the unbounded game by bounded ones with positive initial state distributions. The next result concerns the constrained discounted games on a general state space. In this case, it is possible to prove the existence of a weak correlated equilibrium and give an approximation of an original game by games with countable state spaces. This talk is based on two recent papers with Andrzej S. Nowak.

Local time pushed mixed stopping times and a smooth fit principle for time-inconsistent stopping problems

Andi Rares Bodnariu

Stockholm University, Sweden

We are investigating a game theoretic approach to a time inconsistent stopping problem, which arises when considering a non-exponential discount function called the weighted discount (WDF) function. It has recently been shown by Tan, Ken Seng, Wei Wei, and Xun Yu Zhou. “Failure of smooth pasting principle and nonexistence of equilibrium stopping rules under time-inconsistency." SIAM Journal on Control and Optimization 59.6 (2021): 4136-4154, that for a real options problem under the GBM a pure Nash equilibrium is not guaranteed to exist. In order to try to establish existence of mixed equilibria, we consider strategies where the stopping rule is given by a certain local time push affecting the probability of stopping combined with the intensity of a Cox process. Using this class of strategies, we define a mixed Nash equilibrium and investigate the real options problem presented in Tan et. al.

A dividend problem with a constraint on the ruin time: the time-inconsistent view

Josef Strini

University of Graz, Austria

Aiming at the combination of two prominent problems in risk theory, namely of maximizing dividends and limiting the risk of ruin, we consider the classical dividend problem in a diffusion setting in the presence of a ruin penalty. This formulation originates from the task of maximising dividends subject to a constraint on the Laplace transform of the ruin time. Motivated by the basic idea of keeping track of the ruin probability, we consider different discount rates for the dividend and the penalty part. Certainly, this causes the time-inconsistency of the problem. In the case we operate until the ruin event and using constant coefficients for the state process, we can detect an explicit equilibrium control strategy and the associated equilibrium value function. Furthermore, this solution is used in order to meet the constraint in the original considered scope. Additionally, we modify the problem by introducing a deterministic finite time horizon and present a numerical solution approach.

On the gain of collaboration

Maike Klein

CAU Kiel, Germany

We consider two companies with endowment processes given by Brownian motions with drift. The firms can collaborate by transfer payments in order to maximize the probability that none of them goes bankrupt. We derive the optimal strategy for the collaboration if the Brownian motions are correlated and the transfer rate can exceed the drift rates. Moreover, we state the minimal ruin probability in case of perfectly positively correlated Brownian motions. This talk is based on a joint work with Peter Grandits (TU Wien).

Stochastic games with uncertain competition

Erik Ekström ISO

University of Uppsala, Sweden

We study a few different stochastic games of control and stopping, where one of the players acts under uncertain competition. The player whose participation is uncertain is referred to as a ghost, and can be interpreted either as a fraudster or a possible competitor. We obtain Nash equilibria for various ghost games, where the solution method depends on whether the ghost is equipped with a stopping control or with a control of push type. This is joint work with Tiziano De Angelis, Kristoffer Lindensjö, Alessandro Milazzo and Marcus Olofsson.

Variational inequalities on unbounded domains for zero-sum singular-controller vs. stopper games

Andrea Bovo

University of Leeds, UK

We consider a 2-player zero-sum game between a controller and a stopper where the game's payoff is the sum of a terminal cost, a running cost and an action cost, and the dynamics of the underlying process is given by a solution of a d-dimensional singular controlled SDE. The minimiser can choose the control pair that affects from the class of singular controls, whereas the maximiser can choose the time at which the game ends. We prove that the game as a value, i.e., the order of the infimum and the supremum commuted without changing the value of the function, and it is related to a variational inequality with two constraints - an obstacle constraint and a gradient constraint. The solution of the variational inequality is found as the limit function of a sequence of solutions of penalised variational inequalities. Properties of these solutions are proved with both probabilistic and analytic approaches. Moreover, we characterise an optimal strategy for the stopper.

Nash equilibria for relative investors via no-arbitrage arguments

Tamara Göll

KIT Karlsruhe, Germany

We analyze the optimal investment behavior of n agents trading in a general arbitrage-free financial market. The objective function of a single agent, previously used by Lacker and Zariphopoulou (Mean field and n-agent games for optimal investment under relative performance criteria , Mathematical Finance, 29(4):1003–1038, 2019), is given in terms of her own as well as the other $n-1$ agents' terminal wealth. In this context we determine Nash equilibria by solving an auxiliary classical portfolio optimization problem. Moreover we prove that the Nash equilibrium is unique if and only if the solution to the auxiliary problem is unique. This is an open conjecture in Lacker and Zariphopoulou (2019). In the end, we will compare the Nash equilibrium and the optimal solution for a single agent in a more specific setting. Comments : This talk is based on joint work with Nicole Bäuerle `https://arxiv.org/abs/2111.02310` .

Double continuation regions for American options

Zbigniew Palmowski IS

Wroclaw University of Science and Technology, Poland

We consider the Lévy model of the perpetual American call and put options with a negative discount rate. We will consider the continuous observation case as in De Donno et al. (2020) and the Poisson observation case as in Palmowski et al. (2021). In both cases the stopping region that characterizes the optimal stopping time is either a half-line or an interval. The objective of this talk is to obtain explicit expressions of the stopping and continuation regions and the value function, focusing on spectrally positive and negative cases. To this end, we compute the identities related to the first (Poisson) arrival time to an interval via the scale function and then apply those identities to the computation of the optimal strategies. We also discuss the convergence of the optimal Poisson solutions to those in the continuous observation case as the rate of observation increases to infinity. Numerical experiments are also provided. The talk is based on joint papers with Marzia De Donno, José Luis Pérez, Joanna Tumilewicz and Kazutoshi Yamazaki.

Limit Behavior for Optimal Stopping Problems with Finite Time Horizon

Simon Fischer

CAU Kiel, Germany

We consider stopping problems of the form

$$V(t,\mathbf{x}) = \sup_{t\leq\tau\leq 0} E_{(t,\mathbf{x})}[g(\tau, W_\tau)], \tag{0.1}$$

where W is a Brownian motion. We derive a new Martin boundary type integral equation that characterizes the continuation set C of the problem. We use that equation to analyze the behavior of C close the time horizon 0. In particular, we find an explicit description for the limit behavior when $t \to 0$ for a large class of problems.

Risk-sensitive optimal stopping with an unbounded terminal cost function

Damian Jelito

University of Kraków, Poland

We consider an infinite time-horizon risk-sensitive optimal stopping problem for a Feller-Markov process. We show that if the terminal cost function is unbounded, the associated Bellman equation may admit more than one solution. Also, we provide a probabilistic interpretation of the extremal ones and a sufficient condition for the uniqueness. The analysis covers both discrete and continuous time frameworks and is illustrated by specific examples with explicit multiple solutions to the Bellman equation. The talk is based on the joint work with Ł. Stettner (arXiv:2104.00731, accepted for publication in Electronic Journal of Probability).

Stopping problems with an unknown state

Yuqiong Wang

Uppsala University, Sweden

We extend the classical setting of an optimal stopping problem to include for an unknown state with two possible values. The framework allows the unknown state to influence (i) the drift of the underlying process, (ii) the payoff function, and (iii) the distribution of the random horizon. The stopper seeks to optimise an expected payoff, with an inherent trade- off between stopping and learning about the unknown state. Since the stopper can observe the underlying process and the random horizon, this is a two-source learning problem, and if assigning a prior distribution for the two states, filtering theory can be used to embed the problem in a Markovian framework (joint work with Erik Ekström).

Controlled measure-valued martingales: a viscosity solution approach

Sigrid Källblad IS

KTH Stockholm, Sweden

We consider a class of stochastic control problems where the state process is a probability measure-valued process satisfying an additional martingale condition on its dynamics, called measure-valued martingales (MVMs). We establish the 'classical results' of stochastic control for these problems: specifically, we show that the value function for the problem can be characterised as the unique solution to a Hamilton-Jacobi-Bellman equation in the sense of viscosity solutions. In order to obtain this result, we exploit structural properties of the MVM processes; in particular, we present an appropriate version of Itô's formula for controlled MVMs and an existence result for an SDE featuring MVMs. We also illustrate how problems of this type arise in a number of applications, including model-independent derivatives pricing and the optimal Skorokhod embedding problem. The talk is based on joint work with Alex Cox, Martin Larsson and Sara Svaluto-Ferro.

Optimal stochastic control of a path-dependent risk indicator for insurance companies

Leonie Brinker

University of Köln, Germany

The drawdown of a stochastic process (modelling the surplus of a company) is the absolute distance to its historical high water mark. It can therefore be interpreted as a 'relative loss' and is a risk and performance measure widely used in financial applications: whilst large and long-lasting drawdowns might manifest existing financial and reputational risks, small and infrequent drawdowns can be considered a sign of economic strength and stability. For this reason, minimising drawdowns is desirable for companies — especially in insurance, where customer trust is the basis for success. In this talk, we consider a stochastic control problem inspired by the minimisation of the drawdown size and 'recovery time' for insurance companies. By exploiting connections to Laplace transforms of passage times, Hamilton-Jacobi-Bellman equations and reflected stochastic differential equations, we find value functions and optimal strategies. We discuss our results and implications of the model in explicit examples. Comments : This talk is based on joint work with Hanspeter Schmidli.

Optimal reinsurance and risk measures in a partially observable contagion model

Claudia Ceci

University Chieti-Pescara, Italy

We study an optimal reinsurance problem under the criterion of maximizing the expected utility of terminal wealth when the loss process exhibits jump clustering features and the insurance company has restricted information about the claim arrival intensity. By solving the filtering problem we reduce the original problem to a stochastic control problem under complete information and characterize the value process and the optimal reinsurance strategy in terms of a suitable BSDE. We finally investigate the properties of the dynamic risk measure associated with the BSDE solution. Keywords: Optimal reinsurance; Partial information; Hawkes processes; Cox processes with shot noise; BSDEs; Risk measures. Comments: The talk is based on a paper with Matteo Brachetta, Politecnico di Milano, matteo.brachetta@polimi.it Giorgia Callegaro, University of Padova, gcallega@math.unipd.it Carlo Sgarra, Politecnico di Milano, carlo.sgarra@polimi.it

Friday, March 18

Dynamic Surplus Optimization with Performance- and Index-Linked Liabilities

Sascha Desmettre

University of Linz, Austria

The increasing importance of liability-driven investment strategies and the shift towards retirement products with lower guarantees and more performance participation provide challenges for the development of portfolio optimization frameworks which cover these aspects. To this end, we establish a general and flexible terminal surplus optimization framework in continuous time, allowing for dynamic investment strategies and stochastic liabilities, which can be linked to the performance of an index or the asset portfolio of the insurance company. Besides optimality results in a fairly general surplus optimization setting, we obtain closed-form solutions for the optimal investment strategy for various specific liability models, which include the cases of index-linked and performance-linked liabilities and liabilities which are completely or only partially hedgeable. We compare the results in numerical examples and study the impact of the performance participation, unhedgeable risk components, different ways of modeling the liabilities and the relative risk aversion parameter. We find that performance- or index-linked liabilities, which provide a close link between the wealth of the insurance company and its liabilities, allow for a higher allocation in the risky investment. On the other hand, unhedgeable risks reduce the allocation in the risky investment. We conclude that, aiming at a high expected return for the policy holder, insurance companies should try to connect the performance of insurance products closely to the wealth and minimize unhedgeable risks. Comments : The corresponding paper is joint work with M. Wahl and R. Zagst (both TU Munich) and appeared in European Actuarial Journal, August 24, 2021, https://doi.org/10.1007/s13385-021-00292-z

Numerical Approximation of Gerber-Shiu Functions in a Markovian Shot-Noise Model

Simon Pojer

University of Graz, Austria

In ruin theory, one of the simplifications of the classical Cramér-Lundberg model is the constant intensity of the underlying counting process. To resolve this issue, we consider a model whose jump process is driven by a Markovian shot-noise process. By the recurrent behaviour of the intensity process, we can identify renewal equations whose convergence give us the asymptotic behaviour of corresponding Gerber-Shiu functions. Using the underlying PDMP structure, we can rewrite these discounted penalty functions as unique solutions of Feynman-Kac type partial integro-differential equations. Exploiting the convergence of related Markov processes, we derive a numerical scheme that allows us to calculate approximations of these values.

Stochastic Optimal Control of Thermal Energy Storages

Paul Honore Takam

BTU Cottbus-Senftenberg, Germany

Thermal storage facilities help to mitigate and to manage temporal fluctuations of heat supply and demand for heating and cooling systems of single buildings as well as for district heating systems. We focus on a heating system equipped with several heat-production units using also renewable energies and an underground thermal storage. The thermal energy is stored by raising the temperature of the soil inside the storage. It is charged and discharged via heat exchanger pipes filled with a moving fluid. Besides the numerous technical challenges and the computation of the spatiotemporal temperature distribution in the storage also economic issues such as the cost-optimal control and management of such systems play a central role. The latter leads to challenging mathematical optimization problems. There we incorporate uncertainties about randomly fluctuating renewable heat production, environmental conditions driving the heat demand and supply. The dynamics of controlled state process is governed a PDE, a random ODE driving by the difference between supply and demand, and the SDEs. Model reduction techniques are adopted to cope with the PDE describing the spatio-temporal temperature distribution in the geothermal storage. Finally, time-discretization leads to a Markov decision process for which we apply numerical methods to determine a cost-optimal control. This is a joint work with Ralf Wunderlich (BTU Cottbus-Senftenberg) and Olivier Menoukeu Pamen (AIMS Ghana, University of Liverpool).

Stochastic Epidemic Models with Partial Information and Dark Figure Estimation

Ralf Wunderlich

BTU Cottbus-Senftenberg, Germany

Mathematical models of epidemics such as the current COVID-19 pandemics often use compartmental models dividing the population into several compartments. Based on a microscopic setting describing the temporal evolution of the subpopulation sizes in the compartments by stochastic counting processes one can derive macroscopic models for large populations describing the average behavior by associated ODEs such as the celebrated SIR model. Further, diffusion approximations allow to address fluctuations from the average and to describe the state dynamics also for smaller populations by stochastic differential equations (SDE). Usually not all of the state variables are directly observable and we are facing the so-called “dark figure” problem addressing for example the unknown number of asymptomatic and non-detected infections. Such not directly observable states are problematic if it comes to the computation of characteristics of the epidemic such as the effective reproduction rate and the prevalence of the infection within the population. Further, the management and containment of epidemics relying on solutions of (stochastic) optimal control problems and the associated feedback controls need observations of the current state as input. The estimation of unobservable states based on records of the observable states leads to a non-standard filtering problem for partially observable stochastic models. We adopt the extended Kalman filter approach coping with non-linearities in the state dynamics and the state-dependent diffusion coefficients in the SDEs. This allows to develop approximative solutions to that filtering problem. Numerical results illustrating our theoretical finding are presented. This is joint work with Florent Ouabo Kamkumo and Ibrahim Mbouandi Njiasse (Cottbus).

Optimal bidding strategies for digital advertising with social interactions

Huyên Pham ISO

University Paris 7 Diderot, France

With the emergence of new online channels and information technology, digital advertising tends to substitute more and more to traditional advertising by offering the opportunity to companies to target the consumers/users that are potentially interested by their products or services. We introduce a continuous time model for the study of optimal bidding strategies associated to different types of advertising, namely, commercial advertising for triggering purchases or subscriptions, and social marketing for alerting population about unhealthy behaviours (anti-drug, vaccination, road-safety campaigns). Our framework encodes users online behaviours via their web-browsing at random times, social interactions in a large population of users, and the targeted advertising auction mechanism widely used on Internet. We address the attribution problem of how to efficiently diffuse advertising information by means of digital channels in order to generate conversion. Our main results are to provide semi-explicit formulas for the optimal value and bidding policy in various contexts of commercial advertising and social marketing. We show sensitivity properties of the solution with respect to model parameters, and analyse how the different sources of digital information accessible to users including the social interactions affect the optimal bid for advertising auctions. We also study how to efficiently combine targeted advertising and non-targeted advertising mechanisms. Finally, some classes of examples with fully explicit formulas are derived.

Joint work with Médéric MOTTE (LPSM)

List of Participants

Aichinger, Florian	Linz, Austria
Aydogan Burcu	Aachen, Germany
Bäuerle, Nicole	Karlsruhe, Germany
Belak, Christoph	Berlin, Germany
Benth, Fred	Oslo, Norway
Biagini, Sara	Rome, Italy
Bodnariu, Andi Rares	Stockholm, Sweden
Bovo, Andrea	Leeds, UK
Brinker, Leonie	Köln, Germany
Burzoni, Matteo	Milan, Italy
Ceci Claudia	Chieti-Pescara, Italy
Christensen, Sören	Kiel, Germany
Christa Cuchiero	Vienna, Austria
Dadzie, Elizabeth	Ghana
Dammann, Felix	Bielefeld, Germany
Desmettre, Sascha	Linz, Austria
Dianetti, Jodi	Bielefeld, Germany
Dufour, François	Bordeaux, France
Ekström, Erik	Uppsala, Sweden
Enzi, Lea	Graz, Austria
Fischer, Simon	Kiel, Germany
Ganet Some, Maalvladedon	Cottbus-Senftenberg, Germany
Göll, Tamara	Karlsruhe, Germany
Hady, Mohamed Elfatih	Cottbus-Senftenberg, Germany
Hallmann, Oskar	Kiel, Germany
Höfer, Sebastian	Karlsruhe, Germany
Jakobs, Jonas	Trier, Germany
Jaśkiewicz, Anna	Wroclaw, Poland
Jelito, Damian	Kraków, Poland
Källblad, Sigrid	Stockholm, Sweden
Kamkumo, Florent Ouabo	Cottbus-Senftenberg, Germany
Kallsen, Jan	Kiel, Germany
Klein, Maike	Kiel, Germany
Klein, Sara	Mannheim, Germany
Körber, Laura	Berlin, Germany
Korveh, Edward	Ghana
Laudagé, Christian	Linz, Austria
Likibi Pellat, Rhoss Beauneur	Ghana
Lie, Han Cheng	Potsdam, Germany
Nendel, Max	Bielefeld, Germany
Neumann, Berenice	Trier, Germany

Njiasse, Ibrahim Mbouandi	Cottbus-Senftenberg, Germany
Palmowski, Zbigniew	Warsaw, Poland
Pham, Huyên	Paris, France
Pojer, Simon	Graz, Austria
Possamaï, Dylan	Zürich, Switzerland
Rapsch, E. Emanuel	Berlin, Germany
Redmann, Martin	Halle-Wittenberg, Germany
Rosemann, Ricarda	Kaiserslautern, Germany
Rothert, Nele	Kiel, Germany
Saß, Jörn	Kaiserslautern, Germany
Schaumann, Peter	Ulm, Germany
Schultz, Boy	Hamburg, Germany
Steffensen, Mogens	Copenhagen, Denmark
Stettner, Łukasz	Warsaw, Poland
Strauch, Claudia	Aarhus, Denmark
Strini, Josef	Graz, Austria
Takam, Paul Honore	Cottbus-Senftenberg, Germany
Thonhauser, Stefan	Graz, Austria
Toukam Tchoumegne, Sorelle Murielle	Cottbus-Senftenberg, Germany
Valett, Henrik	Kiel, Germany
Wang, Yuqiong	Uppsala, Sweden
Wiechert, Sophia	Aachen, Germany
Würschmidt, Maximilian	Trier, Germany
Wunderlich, Ralf	Cottbus-Senftenberg, Germany
Zhu, Shihao	Bielefeld, Germany

Useful Information

Talks will be held in **Wiesenhaus**, Raum I, see map. **Coffee breaks** are also held in this building. The **meals** will be served in the **Tafelhus**.

In order to keep the number of attendees in the lecture room from getting too large, we will be streaming the presentations. The **zoom** link is `https://uni-kiel.zoom.us/j/62285056492?pwd=dUR5SkxhV3BRa0h0WkJWZWFWZXByQT09`. We will also broadcast the lectures in the seminar room of the **Retdachhaus**. However, you can also use all other rooms of the conference center for following the lectures and for discussions.

Please **upload your slides** in time before the start of your session to the following cloud folder. Please make sure that the file name is of the following form: day_time_lastname.pdf, e.g., Tuesday_8_30_strauch.pdf. Link: `https://cloud.rz.uni-kiel.de/index.php/s/QZ2beQR9iQfJcn2`

Wi-Fi will be available during the conference. In some rooms, however, there might be network problems right now.


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nach Niendorf
nach Travemünde
zur Hermannshöhe
barrierefrei
Anzahl Stufen bis zum Eingang
optionale Verbindungstür
ZB Zustellbett
WM Waschmaschine für Gäste
AWO