DIPARTIMENTO
MATEMATICA

UNIVERSITÀ
DEGLI STUDI
DI PADOVA

The FWZ Seminar in Padova

Department of Mathematics
University of Padova
May 16-17, 2019

SCHEDULE:

Thursday 16 May		**Friday 17 May**	
9.45 – 10.20	Thorsten Schmidt	9.45 – 10.20	Christa Cuchiero
10.20 – 11.00	Calypso Herrera	10.20 – 11.00	Stefan Rigger
11.00 – 11.30	*coffee break*	11.00 – 11.45	*coffee break*
11.30 – 12.15	Andrea Mazzoran	11.45 – 12.20	Corina Birghila
12.15 – 13.00	Mariia Soloviova	12.20 – 13.00	Irene Klein
13.00 – 13.45	Tiziano Vargiolu	13.00 – 15.00	*lunch break*
13.45 – 15.20	*lunch break*	15.00 – 15.40	Wahid Khosrawi
15.20 – 16.30	Jakob Heiss Hanna Wutte	15.40 – 16.20	Thomas Krabichler
16.30 – 17.15	coffee break	16.20 – 17.00	Philipp Harms
17.15 – 18.00	Josef Teichmann		
20.00	*dinner*		

VENUE:

Department of Mathematics "Tullio Levi – Civita"
via Trieste 63, Padova
Rooms: 2BC/60 (Thursday morning)
1BC/45 (Thursday afternoon)
2BC/30 (Friday whole day)

ABSTRACTS:

Corina Birghila (University of Vienna)
Pareto robust reinsurance contracts
Abstract: In this talk we attempt to introduce the problem of Pareto robust reinsurance contracts and the connection to distributionally robust optimization. We consider a game theoretic approach, in which both insurer and reinsurer face model ambiguity of underlying losses. Similar to Boonen (2017) and Jiang (2019), we assume that insurance market participants agree to disagree on the probability distribution of losses. The main problem that we aim to study is the convex combination of insurer and reinsurer’s risks under different economic and participation constraints. A possible methodology for solving the problem is proposed.

Philipp Harms (University of Freiburg)
Cylindrical measure-valued processes for term structure modeling
Abstract: I will present a framework for financial term structure modeling using cylindrical measure-valued processes.

Jakob Heiss and Hanna Wutte (ETH Zurich)
Randomized shallow neural networks and their use in understanding gradient descent
Abstract: Today, various forms of neural networks are trained to perform approximation tasks in many fields (including Mathematical Finance). However, it has been questioned how much training really matters, in the sense that randomly choosing subsets of the networks weights and training only a few leads to an almost equally good performance. This motivates us to analyse properties of the optimizers found by the gradient descent algorithm frequently employed to perform the training task. In particular, we consider (shallow) neural networks in which weights are chosen randomly and only the last layer is trained. We believe, that the resulting optimizer converges to the smooth spline interpolation of the training data as the number of hidden nodes tends to infinity. This might give valuable insight on the properties of the solutions obtained using gradient descent methods in general settings.
The main result rigorously proofs that artificial neural networks without explicit regularization implicitly regularize the strain energy $\int(\hat{f}'')^2dx$ when trained by gradient decent by solving very precisely a spline regression problem, under certain conditions. Artificial neural networks are often used in Machine Learning to estimate an unknown function f_{True} by only observing finitely many data points. There are many methods that guaranty the convergence of the estimated $\hat{f}$ to the true function f_{True} as the number of samples goes to infinity. But in practice almost always there is only a finite number n of samples available. Given a finite number of data points there are infinitely many functions that fit perfectly through the n data points but generalize arbitrary bad. Therefore, one needs some regularization to find a suitable function. With the help of the main theorem one can solve the paradox on why training neural networks without explicit regularisation works surprisingly well under certain conditions.

Wahid Khosrawi (ETH Zurich)
Polynomial semimartingales
Abstract: We extend the class of polynomial processes to include stochastic discontinuities. Such an extension has been recently provided in the affine framework and we will show how similar results hold true for the polynomial case.

Irene Klein (University of Vienna)
Utility maximization in a two filtration setting

Thomas Krabichler (ETH Zurich)
Deep ALM
Abstract: There are very promising proofs-of-concept that reinforcement learning may revolutionise valuations and risk management strategies in the financial industry. A cornerstone in this regard is the concept "deep hedging". Accounting for transaction cost and liquidity constraints in the hedging of a multi-dimensional derivative exposure cannot be tackled at all with conventional methods from mathematical finance. Utilising techniques inspired from re-inforcement learning allows to overcome both the complexity and the curse of dimension. We aim at refining these approaches for entire term structures in order to solve classical yet intractable problems from asset-liability-management (ALM).

Andrea Mazzoran (University of Padova)
A forward model for power markets based on branching processes
Abstract: We propose and investigate a model for forward power price dynamics, based on continuous branching processes with immigration. The model proposed describes the forward price dynamics and exhibits jumps clustering features. A similar approach for power markets was already exploited by other authors, like F.E. Benth and F. Paraschiv, who adopted a Gaussian framework for describing the forward curves dynamics. The novelty contained in our approach consists in combining the basic features of Branching Processes in order to get a realistic and parsimonious model setting. We discuss the no-arbitrage issues and the futures dynamics in the present modelling framework. We outline a possible methodology for model calibration.

Stefan Rigger (University of Vienna)
The M1-topology: compactness and applications to particle systems
Abstract: The M1-topology is one of the lesser-known topologies originally introduced by Skorokhod. An advantageous feature of this topology (in comparison to the more widely used J1-topology) is that it is particularly well-suited to deal with monotone functions. We prove a tightness result for processes that can be decomposed into a continuous and a monotone part and highlight its applications to the study of particle systems.

Mariia Soloviova (University of Padova)
Efficient representation of supply and demand curves on day-ahead electricity markets
Abstract: Accurate modeling and forecasting electricity demand and prices are very important issues for decision making in deregulated electricity markets. Short term forecast proved to be very challenging task due to these specific features. We are going to use a relatively new modeling technique based on functional data analysis for demand and price prediction. Supply and demand curves on day-ahead electricity markets are the results of thousands of bid/ask entries in the day-ahead auction, this for all the 24 hours. Our main task is to make an appropriate algorithm to present the information about electricity prices and demands with far less parameters than the original one. The most promising technique to do so is the use of (integrals of) Radial Basis Functions (RBF), which are been used in several other applications. We represent each curve using mesh-free interpolation techniques based on radial basis function approximation. We will present different techniques for this interpolation with an application to the Italian day-ahead market. Based on joint work with T. Vargiolu.

Tiziano Vargiolu (University of Padova)
Optimal installation of solar panels with price impact: a solvable singular stochastic control problem
Abstract: We consider a price-maker company which generates electricity and sells it in the spot market. The company can increase its level of installed power by irreversible installations of solar panels. In absence of any actions of the company, the electricity's spot price evolves as an Ornstein-

Uhlenbeck process, and therefore it has a mean-reverting behavior. The current level of the company's installed power has a permanent impact on the electricity's price and affects its mean-reversion level. The company aims at maximizing the total expected profits from selling electricity in the market, net of the total expected proportional costs of installation. This problem is modeled as a two-dimensional degenerate singular stochastic control problem in which the installation strategy is identified as the company's control variable. We follow a guess-and-verify approach to solve the problem. We find that the optimal installation strategy is triggered by a curve which separates the waiting region, where it is not optimal to install additional panels, and the installation region, where it is. Such a curve depends on the current level of the company's installed power and is the unique strictly increasing function which solves a first-order ordinary differential equation (ODE). Finally, our study is complemented by a numerical analysis of the dependency of the optimal installation strategy on the model's parameters. Based on joint work with T. Koch.

LIST OF PARTICIPANTS:

- Almendra Awerkin (Univ. Padova)
- Corina Birghila (Univ. Vienna)
- Giorgia Callegaro (Univ. Padova)
- Christa Cuchiero (Univ. Vienna)
- Claudio Fontana (Univ. Padova)
- Maddalena Ghio (SNS)
- Alessandro Gnoatto (Univ. Verona)
- Martino Grasselli (Univ. Padova)
- Sandrine Gümbel (Univ. Freiburg)
- Philipp Harms (Univ. Freiburg)
- Jakob Heiss (ETH Zurich)
- Calypso Herrera (ETH Zurich)
- Irene Klein (Univ. Vienna)
- Wahid Khosrawi-Sardroudi (ETH Zurich)
- Thomas Krabichler (ETH Zurich)
- Giulia Livieri (SNS)
- Chong Liu (ETH Zurich)
- Stefano Marmi (SNS)
- Andrea Mazzoran (Univ. Padova)
- Lars Niemann (Univ. Freiburg)
- Stefan Rigger (TU Wien)
- Thorsten Schmidt (Univ. Freiburg)
- Mariia Soloviova (Univ. Padova)
- Josef Teichmann (ETH Zurich)
- Tiziano Vargiolu (Univ. Padova)
- Hanna Wutte (ETH Zurich)