My research interests are in the area of applied mathematics with the main focus on mathematical finance, a field concerned with a rigorous analysis of the financial markets. My recent results are mostly on the theoretical side of the area, see [Mos15, Mos17, CCFM17, Mos18a, Mos18b, MS19b, MS19a, Mos19, MSZ19], and they include the existence, uniqueness, stability and asymptotic analysis of certain stochastic control and stochastic analysis problems, which are in the core of financial mathematics. The papers above include a range of sharp well-posedness results and asymptotic formulas in the context of classical (stochastic analysis and stochastic control) problems as well as a pricing and hedging methodology for a general class of financial instruments in incomplete markets.

My initial interest in the field came from the practical experience of working in the financial industry in Manhattan (this is known as working on Wall Street), where, before starting my Ph.D., I was developing and implementing algorithms for pricing and hedging of interest rate derivatives. This motivates another, more applied direction of my research that is based on the natural evolution of the financial markets, in particular, the appearance of new derivatives, the necessity of the adequate data processing, and more effective implementation of related algorithms, see [Mos05, Mos13, MPS13] for my works on these topics.

I also try to balance theoretical and applied research directions[1], and I plan to employ techniques from my past research, in particular from [Mos18a, MS19b], to certain problems related to statistics[2] and economics[3] as well as to several quite distant areas of mathematics, such as asymptotic analysis of Hamilton-Jacob-Bellman equations and Backward Stochastic Differential equations that however arise from financial mathematics. Thus, among my previous results, [LMŽ18] contributes to both theoretical and applied directions by first establishing then applying asymptotic expansion formulas to a number of practical models used in financial engineering, whereas [MS] addresses certain problems in analysis related to differentiation of measures on non-separable spaces, via techniques from financial mathematics.

For the next four-five years, the focus of the research efforts, however, will be on an approach for pricing, hedging, stability and asymptotic analysis in financial markets that relies on an *increase of dimensionality of the value*

[1] With a skew towards the theory primarily due to my current NSF grant.

[2] A natural extension or rather application of the asymptotic analysis results is to view the model perturbations coming from statistical inference on observational data sets.

[3] [Mos18b] already provides rigorous analysis of the optimal consumption of multiple goods in incomplete semimartingale markets. This problem is formulated in [Mer09] and was suggested to me by the Nobel Prize winner in economics Robert Merton during his visit to UConn in Fall 2016.

function in related stochastic control problems, and that is connected to my previous works [Mos17, Mos18a, MS19a, MS19b]. This line of research is supported by the current NSF CAREER award, and further, within the next three years, I plan to additionally start supervising a postdoc with a background either in stochastic analysis or in partial differential equations on a research project (or projects) related to financial mathematics. In the context of this direction, below is a more detailed list of topics of current and future work, including the interdisciplinary ones:

- asymptotic analysis of optimal investment problem in incomplete semimartingale settings,
- stability of the systems of forward-backward stochastic differential equations,
- sensitivity analysis of certain Hamilton-Jacobi-Bellman equations,
- stability of forward-performance processes under model perturbations,
- the impact of statistical procedures of the estimation of model parameters and partial information on the optimal trading strategy,
- asymptotic analysis of optimal consumption of multiple goods in incomplete markets,
- utility-based pricing in large incomplete markets and in asymptotically complete markets,
- the sensitivity of the utility-based prices to perturbations of the information structure in incomplete markets.

To engage students of various levels, starting from the undergraduate one, I am often trying to look at problems in financial mathematics also in simplified settings of *finite probability spaces*. For example, in Summer 2019, I have supervised an REU project, where undergraduate students successfully established stability and asymptotic analysis of the Föllmer-Schweizer decomposition with respect to model perturbations on finite probability spaces, see [BCJ+19]. Further, my current Ph.D. student is investigating a stochastic control problem in general semimartingale settings, where the corresponding formulation on a finite probability space gives an intuition about the expected result. Also, I am trying to state *abstract versions* of certain (usually stochastic control) problems arising in financial mathematics that have a *measure-theoretic form*, which allows separating the mathematical aspects of the problem from their financial counterparts. As Ph.D. students typically study measure theory earlier than stochastic analysis and stochastic control, abstract versions allow them to start conducting research earlier in the program. Measure-theoretic versions also alleviate establishing the results under weaker, even minimal, conditions, and they were instrumental in my previous works, such as [Mos15, MS19b].

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