Description of the project for the general public

Recursive Methods in Stochastic Games and Decision Processes

Our research project is devoted to recursive methods that are used with a great success in modern risk theory and macroeconomics. This approach takes into account the risk of an uncertain state whose distribution is known and described by either a difference equation or a general transition probability function. Both of them very often depend on decisions of the agents and the current state of an underlying process. These decisions also have an impact on immediate payoffs/costs or felicity functions that reflect the agents' level of satisfaction. In this project, we propose to examine the behaviour of the decision makers in the infinite time horizon, if the expected discounted payoff is replaced by an non-expected one derived with the aid of the certainty equivalents that allow to describe a risk aversion attitude through risk coefficients. Our objective is an application of the aforementioned payoff to a study of various dynamic decision models and non-zero-sum stochastic games. We plan to establish optimal strategies (in case of decision models) or Nash equilibria (in case of games). In particular, we wish to examine a stochastic optimal growth model, in which the consumer decides how much to consume in order to invest a remaining part for future. We also want to consider a dynamic choice model, in which the utility function of a decision maker changes over time (it is a model with a so-called quasi-hyperbolic discounting). Moreover, we would like to apply these payoff criteria to non-zero-sum stochastic games on a general state space and to prove that there exists ϵ-stationary Nash equilibrium. Furthermore, we are going to deal with non-stationary intergenerational games, in which the current generation acting in period t cares about its descendants living and taking actions in periods $t+1, \ldots$. A solution in this problem is a Markov perfect equilibrium obtained in a game, in which there are two players: the current generation and all (or some) future successors. Next part of our research will be dedicated to games with continuum players. They can approximate different conflicts, in which the number of players is so large that only certain group of players may effectively influence on decisions. Finally, it is worth noticing that the theory of stochastic games, mostly non-zero-sum, found its applications in computer science, queueing models, networks and economics. A major part of research is carried at strong research institutions, prestigious universities all over the world, and fundamental papers in this area were published in very good journals from the JCR list.