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**Nonlinear Markov semigroups and processes with applications to statistical**

**mechanics, evolutionary biology and control theory.**

Abstract.

Nonlinear Markov semigroups are the nonlinear semigroups of mapping on the space of probability measures. This  notion extends naturally the notion of usual (linear) Markov semigroups. Similarly, as linear spaces can be considered as tangent spaces to nonlinear manifolds, usual Markov processes can be considered as tangent to nonlinear Markov processes.  Though nonlinear processes are met everywhere in natural  science, economics and natural science, their systematic study was initiated quite recently.

Special aspect of the most recent developments is connected with the control theory of nonlinear processes (nonlinear Markov games and mean-field games) . In the course we develop the basic theory starting from the simplest models. All results will be illustrated

on the concrete  applications to physics (Equation of Boltzmann, Vlasov, Smoluchovskii, Landau, McKean diffusion, nonlinear Schroedinger equation, etc), evolutionary biology (replicator dynamics) and control theory (mean-field games).

The first lectures will be devoted to the most elementary models of competitive control (mean-field games and pressure-resistance games) with a finite state space of each player, leading to a variety of applications like modeling of inspection, corruption, cyber-security, counter-terrorist measures, coalition building, merging and splitting of banks and firms, strategically enhanced preferential attachment growth, etc. Closer to the end of the course, the attention will turn to mathematically more demanding material related to continuous state and continuous time models and the corresponding nonlinear evolutions, with more physics applications in the background