From Brownian to pedestrian motion and Fokker-Planck Nash games

Alfio Borzì

Institut für Mathematik, Universität Würzburg
Chair Mathematik IX - Scientific Computing. alfio.borzi@uni-wuerzburg.de

This talk starts discussing fundamental results of statistical mechanics focusing on Brownian motion and Fokker-Planck (FP) equations and the concept of Nash games. Within the resulting framework, a new approach to modelling pedestrian's avoidance dynamics is presented. This approach leads to the formulation of a Fokker-Planck Nash game problem that models the dynamics of two interacting pedestrian with intrinsic variability and the objectives of reaching a desired destination while avoiding collision. In this way, a FP Nash differential game is formulated where the game strategies represent controls aiming at avoidance by minimizing appropriate collision functionals. The issue of existence of Nash equilibria solutions is considered in the realm of optimal control problems. Results of numerical experiments are presented that successfully compare the computed Nash equilibria to output of real experiments (conducted with humans) for 4 test cases. This talk also aims at outlining the multiple challenges and open problems posed by the solution of FP equations, stochastic control problems, and dynamic games.

References

[1] M. Annunziato, A. Borzì, *A Fokker-Planck control framework for multidimensional stochastic processes*, Journal of Computational and Applied Mathematics, 237 (2013), 487-507.

[2] S. Roy, A. Borzì, A. Habbal, *Pedestrian motion modelled by Fokker - Planck Nash games*, Royal Society open science, 4, (2017) 170648-17.