Prof. Maryam Kamgarpour
Control Systems

Mission
My aim is to advance fundamental understanding of decision making in uncertainty. To this end, I develop theory and algorithms for optimization and control of uncertain large-scale dynamical systems. I address applications ranging from power grid to robotics and air traffic systems.

Curriculum Vitae

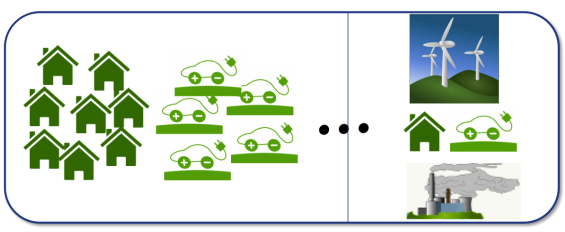
Degrees/Higher Education
2007, 2011: Master's and Ph.D. in Control Systems from the University of California, Berkeley
2005: Bachelor of Applied Sciences in Systems Design Engineering from University of Waterloo, Canada

Professional Career
2016: Professor of Control Systems

Awards
2015: European Union (ERC) Starting Grant 2015
2010: NASA Excellence in Publication Award
2010: NASA High Potential Individual Award

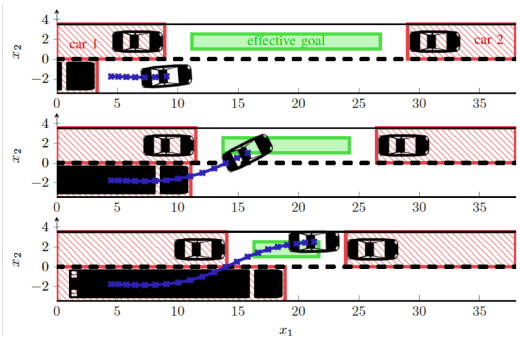
Research Activities

Power grid systems
Our goal is to develop advanced optimization and control algorithms to help in achieving a stable and secure electrical power grid despite increased uncertainties from the renewable energy sources and the liberalised electricity markets. To this end, we develop distributed control and game theory to analyze and optimise multi-player decision making in the power system.



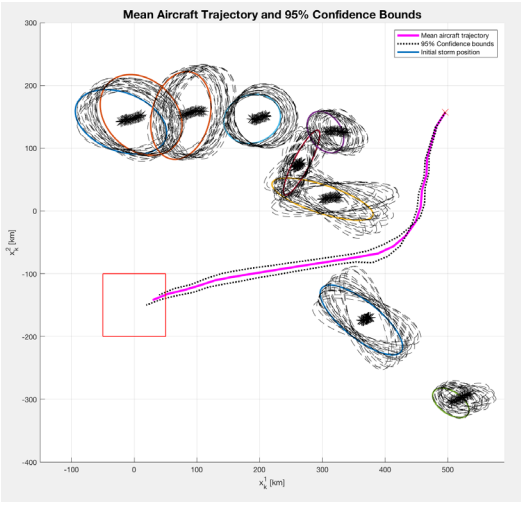
We work on decision making algorithms that ensure grid stability while optimizing individuals' objectives.

Robotics
We have been working on hybrid systems as a framework to capture mixed logic and continuous specifications for uncertain dynamical systems. Building on this framework, our vision is to develop provably safe feedback control policies that can adapt to an underspecified changing environment to achieve complex tasks. The applications we address with this framework include autonomous driving and search and rescue missions in uncertain environments.



An illustration of designing a controller for safe lane change despite uncertainties in intents of the nearby vehicles.

Air traffic control
We develop scalable optimal control algorithms for safe and fuel-efficient aircraft trajectory planning, taking into account environmental uncertainties. We use forecast data on storms and winds to determine safe airspace regions and to optimize aircraft trajectories accordingly. An interesting aspect of this control problem is ensuring the developed algorithms are compatible with air traffic procedures so that they have high levels of human trust and acceptance. We address this issue through collaboration with air traffic controllers.



An illustration of an optimized aircraft trajectory that avoids the stochastic storms, shown with moving ellispes.