

Motion-Planning for Agile Mobility of Autonomous Systems

Aggressive mobility of unmanned autonomous and semi-autonomous ground and aerial vehicles is challenging owing to the short time scales involved and the often nonlinear dynamics necessary to deal with the interaction between the vehicle and the environment. In this talk, we will present recent advances on multi-scale and randomized, sampling-based motion planners for robotic systems that work in high dimensional spaces to capture the vehicle dynamics. By utilizing dynamic programming principles, we will present several algorithms that are able to operate efficiently on large randomized graphs. These algorithms also take advantage of the inherent parallelization of the sampling step to speed up the whole motion-planning process. In case the planning is done solely at the geometric layer, multi-scale algorithms typically work extremely well, by creating hierarchies of search graphs of variable resolution. We will discuss ideas how to construct such graphs efficiently using wavelets and beamlets. Finally, we will also present a methodology to bridge the gap between the geometric and kinodynamic layers of the problem to ensure path feasibility.