Monte Carlo Motion Planning for Robot Motion Optimization Under Uncertainty

In this talk we will address the problem of motion planning under uncertainty, in particular the problem of computing a low-cost robot trajectory subject to a constraint on collision probability (CP). I will discuss how "typical" approaches to CP estimation, by neglecting correlations among pointwise CPs, can be quite inaccurate, thus potentially mischaracterizing the feasible domain of trajectory optimization. This will motivate the discussion of a novel class of asymptotically-exact estimators for CPs, which rely on Monte Carlo sampling made computationally viable through statistical variance-reduction techniques. Finally, we will present parallel algorithms, designed for GPU implementation, that use such estimators to compute low-cost, verifiably-safe trajectories for agile autonomous systems in ~100ms.