Robot path planning via random sampling: some remarks about controllability and combinatorial topology.

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For small-time controllable systems moving among obstacles, the existence of a collision-free path between two points is characterized by the existence of a single connected component containing both points in the collision-free space. Making this property effective requires the use of (exact) steering methods (e.g., open loop controls). Their choice is critical with respect to combinatorial issues.

In this talk we introduce the so called "visibility roadmaps": they are graphs tending to capture both coverage and connectness of the collision-free space. In a first part we will see that the existence of such roadmaps depends on the considered steering method. Then we will present a probabilistic algorithm to compute them. We will illustrate the performance of the algorithm for path planning via Move3D, a software platform dedicated to path planning. Finally we will conclude on open questions dealing with random sampling and and percolation phenomena.