College of Engineering
TEMPLE UNIVERSITY

Mechanical Engineering
Transformative Science and Technology Engineering Lecture Series

Path-planning for fleets of car-like vehicles, with almost-surely guaranteed convergence

Abstract: A common approach to path planning for a fleet of vehicles involves two levels: large-scale planning which designates long-term individual routes for each vehicle, and small-scale planning that coordinates collision-free interactions between small numbers of vehicles. Focusing on the small-scale part of the problem, we provide a planner that provides (near-)optimal choreographies for a small fleet of vehicles performing coordinated collision-free maneuvers in a spatially constrained environment. The work consists of three parts: (1) setting up the configuration space, which involves some discussion of non-Euclidean geometry for the Reeds-Shepp vehicle model; (2) verifying the validity of the RRT* planner in the non-Euclidean setting, which involves verifying that RRT* is applicable to this setting, and (3) validating the method in C++. Critically, we find a flaw in the original proof of convergence for RRT* in Euclidean space and provide a new proof in a broader framework applicable to Euclidean and non-Euclidean spaces.

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Bio: Anton Lukyanenko got his BS/MA at the University of Maryland under the direction of Bill Goldman, and his PhD at the University of Illinois Urbana-Champaign under the direction of Jeremy Tyson. He studies the geometry of non-Euclidean spaces from the perspectives of analysis, number theory, algorithms, and visualizations. This includes work on a wide range of topics, including geometric group theory, analysis on fractals, continued fractions, Diophantine approximation, and path-finding for non-holonomic robotic systems. Recently, Dr. Lukyanenko joined the Quantum Science and Computing Center and has been exploring the interactions of quantum computing with computational geometry.

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12:00 PM

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