LCIS
Laboratoire de Conception et d'Intégration des Systèmes

Seminar

Thursday, 18 September 2025
13:15, D008
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Title: Potential Field Methods in Control

Abstract: Obstacle avoidance and target tracking are two key challenges in motion planning. One approach relies on harmonic functions. After an initial cell decomposition, a harmonic potential surface is generated from Dirichlet-type boundary conditions on each cell. By employing cardinal B-spline curves, we mitigate the steep gradients often reported in the literature. With a potential surface computed for every cell, the agent moves along a chain of such cells to reach the target while avoiding obstacles. A second approach is based on navigation functions. Starting from a spherical world, one can map the configuration space into other topologies via diffeomorphic transformations; for instance, the sum-function method admits polyhedral domains. While the Koditschek–Rimon framework for navigation functions is theoretically well established, the literature provides little practical detail on the numerical computation of the associated bounds. We present a complete implementation of these bounds and outline future directions aimed at reducing their conservatism.

Short bio: Theodor-Gabriel Nicu is a PhD candidate and Teaching Assistant in the Automatic Control and Systems Engineering Department of the National University of Science and Technology Politehnica Bucharest, Romania. He received BSc and MSc degrees in the Systems Engineering domain from the Politehnica University of Bucharest, in 2020 and 2022, respectively. Since 2024 he is also affiliated with the CAMPUS Research Institute, his current research interests being focused mainly on the Artificial Potential Field approach for obstacle collision avoidance algorithms, B-spline representations and also Mixed-Integer representations..