COLLEGE OF ENGINEERING

Control Seminar

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A Homotopy Method for Motion Planning With Application to Wheeled Vehicles

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ABSTRACT: We present a novel method for motion planning for control systems with holonomic, non-holonomic and obstacle constraints. The method proceeds by deforming an arbitrary path joining the initial state of the system to a desired final state into an admissible path, that is a path that meets the various constraints of the problem. The method builds on relatively recent developments in geometric analysis. In a nutshell, it consists of encoding the various constraints of the problem in an appropriately-defined inner product which is then used to derive a parabolic partial differential equation whose solution provides the sought homotopy between an arbitrary path and a feasible trajectory for the system to follow. We will present the method in details and apply it to various canonical motion planning examples.

BIO: M.-A. Belabbas obtained his PhD degree in applied mathematics from Harvard University and his undergraduate degree from Ecole Centrale Paris, France, and Universite Catholique de Louvain, Belgium. He is currently an associate professor in the Electrical and Computer Engineering department at the University of Illinois, Urbana-Champaign and at the Coordinated Science Laboratory. His research interests are in Networked Control System, Stochastic Control and Geometric Control theory. He was a recipient of the 2014 NSF Career Award.

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