Eduardo Martínez

Optimal Control on Lie Groupoids

Abstract:

Discrete Lagrangian Mechanics on Lie groupoids was introduced in~[1] and further developed in~[2], for the holonomic case, and in~[3] for nonholonomic systems. This formalism allows to describe the discrete analogs of continuous systems on Lie algebroids, as can be obtained, for instance, by an adequate discretization.

Such results can be naturally extended for discrete-time optimal control problems defined on Lie groupoids for kinematic and for dynamic problem. By an adequate study of the admissible variations we will find the optimality conditions, that will be expresed in terms of composability in a groupoid. I will show some examples and we will further study symmetry and reduction theory as well as some discretization algorithms for solution of continuous problems.

[1] A. Weinstein: Lagrangian Mechanics and groupoids,

\textsl{Fields Inst. Comm.} \textbf{7} (1996) 207--231.

[2] J.C. Marrero, D. Mart\'{\i}n de Diego and E. Mart\'{\i}nez:

Discrete Lagrangian and Hamiltonian mechanics on Lie groupoids,

\textsl{Nonlinearity} \textbf{19} (2006) 1313--1348.

[3] D. Iglesias, J.C. Marrero, D. Martín de Diego and E. Martínez

Discrete nonholonomic Lagrangian systems on Lie groupoids,

\textsl{Journal of Nonlinear Science} \textbf{18} (2008) no.~3, 221--276