Iglesias, David; Marrero, Juan C.; Martín de Diego, David; Martínez, Eduardo
Discrete nonholonomic Lagrangian systems on Lie groupoids. (English) [Zbl 1182.37036]

The authors study the construction of geometric integrators for nonholonomic systems. A formalism for nonholonomic discrete Euler-Lagrange equations is developed in terms of Lie groupoids, specifying a discrete Lagrangian and a constraint submanifold. By using the unifying point of view of Lie groupoids, the authors recover all the previous methods in the literature and consider new cases of great importance in nonholonomic dynamics. Several examples are carefully studied illustrating the wide range of applications of the theory: the discrete nonholonomic constrained particle, the Suslov system, the Chaplygin sleigh, the Veselova system, the rolling ball on a rotating table and the two wheeled planar mobile robot. While the numerical treatment of holonomic systems has been studied extensively, nonholonomic systems have been much less studied. In this sense, this paper makes a very interesting and valuable theoretical contribution to the subject.

Reviewer: Jesús Marín-Solano (Barcelona)

MSC:
37J60 Nonholonomic dynamical systems
37M15 Discretization methods and integrators (symplectic, variational, geometric, etc.) for dynamical systems
17B66 Lie algebras of vector fields and related (super) algebras
22A22 Topological groupoids (including differentiable and Lie groupoids)
70F25 Nonholonomic systems related to the dynamics of a system of particles
70H03 Lagrange’s equations
65P10 Numerical methods for Hamiltonian systems including symplectic integrators

Keywords:
discrete mechanics; nonholonomic mechanics; Lie groupoids; Lie algebroids; reduction; nonholonomic momentum map

Full Text: DOI arXiv

References:


