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Symplectic groupoids and discrete constrained Lagrangian mechanics.

The subject of discrete Lagrangian mechanics concerns the study of certain discrete dynamical systems on manifolds, whose geometric features are analogous to those in classical Lagrangian mechanics. While these systems are quite mathematically interesting, in their own right, they also have important applications to structure-preserving numerical simulation of dynamical systems in geometric mechanics and optimal control theory. In fact, these structure-preserving properties are intimately related to the geometry of symplectic groupoids, Lagrangian submanifolds, and generating functions. In this talk, we describe how a more general notion of generating function can be used to construct Lagrangian submanifolds, and thus discrete dynamics, even for systems with constraints. Within this framework, Lagrange multipliers and their dynamics are shown to arise in a natural way. (Received July 30, 2013)