Properties of Hamiltonian Variational Integrators

Abstract:
The field of geometric numerical integration (GNI) seeks to exploit the underlying (geometric) structure of a dynamical system in order to construct numerical methods that exhibit desirable properties of stability and/or preservation of invariants of the flow. Variational Integrators are built for Hamiltonian systems by discretizing the generating function of the symplectic flow, rather than discretizing the differential equations directly. Traditionally, the generating function considered is a type I generating function. In this talk we will discuss the properties and advantages/disadvantages of discretizing the type II/III generating function of the flow. After establishing error analysis and adjoint results, we consider the possible numerical resonance properties corresponding to the different types of generating functions.