Structure-preserving numerical integrators: classic methods, new perspectives

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Abstract
Differential equations arising in scientific and statistical computing often have important structures that one would like a numerical simulation to preserve: conserved quantities, invariant measures, etc. However, standard numerical integrators typically fail to preserve these structures, leading to simulations with incorrect physical or statistical features. In this talk, I will begin by surveying some classic results on structure-preserving numerical integration methods, which correctly preserve these invariants. Then, I will present some new results, showing that these methods also correctly capture the evolution of certain non-invariant observables. This has important implications for the application of structure-preserving methods to non-conservative (e.g., dissipative) systems.