Symmetry Preservation in Hamiltonian Systems: Simulation and Learning

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Symmetry has always played a pivotal role in understanding Hamiltonian systems. Whilst the key concept in general Hamiltonian systems is Lagrangian submanifolds, when symmetry is present symmetry-invariant Lagrangian submanifolds play the main role. In this poster we present a novel technique to generate all invariant Lagrangian submanifolds that can be used both to simulate or to learn systems with symmetry. Our constructions result in integrators and learning mechanisms that conserve the corresponding momentum mapping. Extensions to the Poisson setting are also introduced and, finally, a general process to "geometrize" and endow with symmetry non-geometric integrators is presented.

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