

Hamiltonian integrability via Malgrange pseudo group.

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We consider a 2 degree of freedom rational Hamiltonian H . Arnold Liouville integrability requires the existence of an additional first integral. We want to relax the condition of existence of an additional first integral by requiring only the preservation of a codimension 1 foliation transverse to the levels of H . The Malgrange pseudo group is defined in terms of differential invariants, so when such a codimension 1 foliation is preserved, the Malgrange pseudo group is not maximal. We present differential Galois conditions on the variational equations near Darboux points for homogeneous potentials for proving this non maximality. We then apply it to prove maximality of the Malgrange pseudo group for most homogeneous polynomial potentials of degree 3. At last, we look for potentials preserving a codimension 1 foliation, by looking for compatible vector fields of degree 1 in momenta. Among non Arnold Liouville integrable potentials, we find exactly the bihomogeneous potentials, and homogeneous potentials of degree 0.

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