

HAMILTONIAN FLOW OF SINGULAR TRAJECTORIES

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The Pontryagin maximum principle reduces problems of optimal control to the study of Hamiltonian systems of ODEs with discontinuous right-hand side. Optimal synthesis is the set of solutions of this system with a fixed end (or initial) condition covering a certain region of the phase space in a unique way. Singular trajectories play key role in the construction of an optimal synthesis. These trajectories lie in the surface of discontinuity of the right-hand side of the Hamiltonian system.

On the report, recently proved theorem on Hamiltonian property of singular flow will be discussed. Namely, the set of singular trajectories of a fixed order forms a symplectic manifold, and the singular flow on it is Hamiltonian.

The result is constructive and makes it possible to apply the full spectrum of the theory of Hamiltonian systems to the study of singular trajectories. As an example of the use of this theorem I consider the control problem of magnetized Lagrange top in a changing magnetic field. It is proved that the flow of singular trajectories in this problem is completely integrable in the Liouville sense and is included in the flow of a smooth superintegrable Hamiltonian system in the ambient space. Direct study of this problem (without using the proposed technique) is seemed to be impossible because of the huge complexity of direct calculations.

References

1. *Lokutsievskiy L. V.* Hamiltonian flow of singular trajectories. // *Mat. Sb.*, 2014, Volume 205, Number 3, Pages 133–160 (Mi msb8248).