

# Introduction to Geometric control Theory

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A control system is a family of dynamical systems defined on the same state space. The family is parameterized by some parameters and it is allowed to change the values of parameters (i.e. to switch from one dynamics of the family to another one) at any time moment. Control function is a way to choose parameters as a function of time.

Different dynamical systems of the family usually do not commute. In other words, the state where the system arrives at prescribed time heavily depends on the order in which we activate different dynamics and on the number of switchings. The structure and behaviour of the control system is actually determined by the commutator relations between the flows generated by the involved dynamical systems.

A central object of the mathematical control theory is the *endpoint map* that sends control functions in the values of trajectories at prescribed time moments. In this mini-course we will discuss analytic and geometric properties of the endpoint map, controllability properties of control systems, optimal control, and fast-oscillating control.