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Title : Nonlinear control design via Lyapunov functions

**Abstract** : We will present fundamental results pertaining to ordinary differential equations and nonlinear control theory. In particular, we will review the notion of Lyapunov function, the LaSalle Invariance Principle, the Jurdjevic-Quinn's theorem. We will perform constructions of strict Lyapunov functions.

Outline :

1) Introduction to dynamical systems.

Ordinary Differential Equations, discrete-time systems, time-varying systems.  
Notions of stability (local, global, basin of attraction), notion of input-to-state stability.

2) Lyapunov functions.

Lyapunov theorem, converse Lyapunov theorem, LaSalle Invariance Principle. Weak Lyapunov functions, strict Lyapunov functions. Notion of ISS Lyapunov function.

3) Construction.

Constructions of strict Lyapunov functions, time-invariant and time-varying cases.

4) Basin of attraction.

Determination of an estimate of a basin of attraction via a strict Lyapunov functions.

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