

Introduction to nonsmooth dynamical systems

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Contents

- ▶ Lecture 1. Introduction and motivations
 1. Motivations for studying nonsmooth dynamical systems
 2. An archetypal example: a RLC circuit with an ideal diode
 3. Basics on convex and nonsmooth analysis
- ▶ Lecture 2. Mathematical formulations and results
 1. Mathematical formalism (Differential inclusions and variational inequalities, complementarity systems)
 2. Existence and uniqueness results.

Practical work : study of a slider with friction and basic circuits with a diode.

- ▶ Lecture 3. Stability in nonsmooth dynamical systems.
 1. Computation of equilibria
 2. Lyapunov Stability.

Practical work : Stability and bifurcations in electrical circuits and mechanical systems with friction.

Practical work : Simulation of a Diode-bridge with the Siconos software.

Illustrations of large scale systems.

Objectives

- ▶ To be acquainted with the standard notation and definitions of nonsmooth dynamical systems.
- ▶ To know the standard tools for mathematical analysis.
- ▶ To know how to state the stability of nonsmooth dynamical systems

References

- [1] V. Acary and B. Brogliato. *Numerical methods for nonsmooth dynamical systems. Applications in mechanics and electronics*. Lecture Notes in Applied and Computational Mechanics 35. Berlin: Springer. xxi, 525 p. , 2008.
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- [2] J. Bastien, F. Bernardin, and C. Lamarque. *Systèmes dynamiques discrets non réguliers déterministes ou stochastiques*. Hermes, Lavoisier, 2012.
- [3] D. Goeleven. *Complementarity and Variational Inequalities in Electronics*. Academic Press, 2017.
- [4] R.I. Leine and H. Nijmeijer. *Dynamics and Bifurcations of Non-Smooth Mechanical Systems*. Lecture Notes in Applied and Computational Mechanics 18. Springer verlag, 2004.