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Piecewise Deterministic Markov Processes

A Piecewise Deterministic Markov Process (PDMP) is defined by a (finite) family of deterministic dynamical systems (usually ordinary differential equations) and a random clock. The system follows a given dynamic, and when the clock rings, it switches to another dynamic, randomly chosen. This type of process naturally appears in several fields (population dynamics, cell biology, computer science, etc.) where the system's evolution is deterministic but depends on an environment subject to random fluctuations.

The qualitative analysis of the long-term behavior of PDMPs has been the focus of much attention over the last decade. In this talk, I will offer a general introduction to the subject, illustrate my points with several examples, and present the main results obtained — in collaboration with several researchers — over the past ten years.

References

- Regularity of invariant densities for random switching between two linear odes in R^d (with Améthyste Bichard) ***Siam Journal on Applied Dynamical Systems, 2025***
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- Random Switching between vector fields having a common equilibrium (with Edouard Strickler) ***Annals of Applied Probability, 2019***
- Supports of Invariant Measures for Piecewise Deterministic Markov Processes (with Fritz Colonius and Ralph Lettau) ***Nonlinearity*, 2017,**
- Lotka Volterra in fluctuating environment or "how switching between beneficial environments can make survival harder (with Claude Lobry) ***Annals of Applied Probability,* 2016**,
- Qualitative properties of certain piecewise deterministic Markov processes (with Stéphane Le Borgne, Florent Malrieu and Pierre-André Zitt ***Annales de l'IHP, 2015***