



# Workshop on Stochastic Analysis

IMECC - Unicamp

From August 10th to 13th, 2026



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## **PERSISTENCE, PERMANENCE, AND EXTINCTION IN INFINITE-DIMENSIONAL RANDOM DYNAMICAL SYSTEMS**

### **Abstract**

We develop a random dynamical systems framework for analyzing fundamental biological phenomena such as persistence, permanence, and extinction in infinite-dimensional state spaces. Our analysis is based on asymptotically random cocycles, for which we establish the existence and qualitative structure of the associated random attractors. Under suitable assumptions, these attractors are shown to be compact, invariant, minimal, and connected, providing a rigorous description of the asymptotic dynamics of randomly evolving systems. We then demonstrate how these structural properties yield natural criteria for persistence and extinction, thereby connecting the long-term behavior of the random dynamical system with biologically meaningful outcomes. The proposed framework unifies the study of stochastic population dynamics in infinite-dimensional settings and provides a mathematical foundation for investigating biological systems subject to environmental randomness.