JIHOON LEE



Professor of Mathematics

Department of Mathematics, Chonnam National University, Republic of Korea

RESEARCH & COLLABORATION PROFILE

KEY WORDS: Infinite-Dimensional Dynamics, PDEs, Fredholm Theory, Exponential Dichotomy, Invariant Manifolds, Morse–Smale Systems

Research Snapshot. My research concerns infinite-dimensional dynamical systems and the long-term behavior of nonlinear PDEs. I use Fredholm theory, exponential dichotomy and admissibility to study hyperbolicity, invariant manifolds and structural properties, with applications to reaction–diffusion and damped wave equations, finite-dimensional reduction and perturbation problems.

RESEARCH EXPERTISE

- **Infinite-dimensional dynamics:** qualitative analysis of evolution equations and the structure of nonlinear PDE flows.
- **Linear and nonlinear analysis:** Fredholm operators, exponential dichotomy and admissibility in dynamical systems.
- **Invariant and inertial manifolds:** regularity, persistence, inertial forms and finite-dimensional reduction.
- **Hyperbolicity and genericity:** Sard–Smale methods, generic hyperbolicity and Morse–Smale systems.
- **Model equations:** reaction–diffusion and damped wave equations, including Chafee–Infante type problems.

RECENT RESEARCH HIGHLIGHTS

- **Fredholm theory under ADP/APC:** analysis of Fredholm properties under ADP/APC assumptions and their role in PDE dynamics.
- **Generic hyperbolicity:** Sard–Smale approaches to genericity and the structure of equilibria and dynamical systems.
- **Weighted admissibility:** trajectory-weighted admissibility and the construction of C^1 invariant manifolds.
- **Perturbation of reduced dynamics:** inertial manifold perturbation for damped wave and reaction–diffusion equations, including singular and domain perturbations.

POTENTIAL COLLABORATION RESEARCH

Collaborator areas: PDE dynamics | nonlinear functional analysis | evolution equations | spectral and Fredholm methods

- **PDE dynamics and genericity:** study hyperbolicity, transversality and Morse–Smale structures in dissipative evolution equations.
- **Fredholm and admissibility methods:** develop operator-theoretic tools for linearized flows and invariant manifold problems.
- **Invariant and inertial manifolds:** investigate regularity, persistence and finite-dimensional descriptions of PDE dynamics.
- **Singular and domain perturbations:** analyze stability of invariant structures and reduced dynamics as equations or spatial domains vary.

SELECTED RECENT PUBLICATIONS

J. Lee, N. Nguyen and V. M. Toi. “Gromov-Hausdorff stability of global attractors of reaction diffusion equations under perturbations of the domain.” J. Differential Equations 269 (2020), 125–147.

J. Lee, N. Nguyen and L. Pires. “Global attractors of generic reaction diffusion equations under Lipschitz perturbations.” J. Math. Anal. Appl. 528 (2023), 127534.

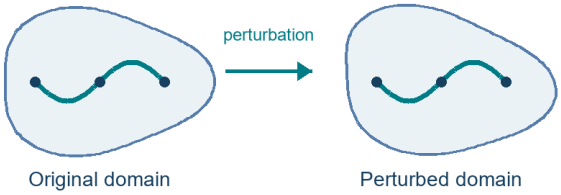
J. Lee and T. Nguyen. “Stability of inertial manifolds for semilinear parabolic equations under Lipschitz perturbations.” Nonlinear Anal. Real World Appl. 81 (2025), 104219.

CONTACT

jihoon@jnu.ac.kr

Department of Mathematics | Chonnam National University

GLOBAL ATTRACTOR STABILITY



Compare attractors in different phase spaces

INERTIAL MANIFOLDS



Exponential attraction and reduced dynamics

Conceptual illustrations of the research themes; curves are schematic.