

Term	Definition
Attractor State	A stable configuration toward which a dynamical system tends to evolve regardless of starting conditions within its basin of attraction.
Basin of Attraction	The set of initial conditions from which a dynamical system evolves toward a particular attractor state.
Barrier height ($\Delta U, \Delta \phi_0$)	energy required for a population to transit from one stable state to another in ecological or biological systems.
Bifurcation	A qualitative change in system behavior that occurs when a small change in a parameter causes a sudden structural change in the system's dynamics.
Bistable Region	A parameter range where two stable states (attractors) coexist, allowing the system to settle in either state depending on initial conditions and perturbations.
Critical Slowing Down (CSD)	The phenomenon where a system takes progressively longer to recover from perturbations as it approaches a bifurcation point, manifested as increasing relaxation time.
Cross-Correlation Function	A statistical measure of similarity between two time series as a function of the displacement of one relative to the other, used to quantify temporal relationships.
Curl Flux (J)	The rotational component of system dynamics that breaks detailed balance and drives non-equilibrium behavior, causing circulation in state space.
Detailed Balance	A condition in equilibrium systems where the probability flux between any two states is balanced, resulting in zero net circulation.
Diffusion Coefficient (D)	A parameter quantifying the intensity of random fluctuations (noise) in a stochastic system.
Dominant Path	The most probable trajectory a system follows when transitioning between stable states.
Entropy Production Rate (EPR)	A thermodynamic quantity measuring the rate at which a non-equilibrium system dissipates energy and generates entropy, quantifying the thermodynamic cost of maintaining non-equilibrium dynamics.
Frequency of the flickering (f_ω)	the number of transitions from one stable state to another stable state per unit time.
Inflection Point	A point on a curve where the curvature changes sign, used to identify significant changes in system behavior.
Intrinsic Free Energy (\mathcal{F})	The free energy of a system calculated in the zero-noise limit, representing fundamental system energetics.
Intrinsic Potential Landscape (ϕ_0)	The potential landscape in the zero-noise limit that serves as a Lyapunov function for determining global stability.
Landscape-Flux Theory	A theoretical framework for analyzing non-equilibrium systems by decomposing dynamics into gradient (landscape) and rotational (flux) components.
Langevin Equation	A stochastic differential equation describing the time evolution of a system subject to random forces.
Lyapunov Function	A scalar function that quantifies a system's stability, decreasing along trajectories and reaching minima at stable equilibria.
Mean First Passage Time ($MFPT, \tau$)	The average time required for a system to transition from one stable state to another, quantifying kinetic switching times between states.
Natural Mortality Rate of Coral (h)	A parameter representing the intrinsic death rate of coral in the coral-algal model.
Non-Equilibrium System	A system that does not satisfy detailed balance conditions and requires continuous energy input to maintain its state.
Phase Diagram	A graphical representation showing different stable states and transition boundaries as functions of control parameters.
Potential Landscape (U)	A mathematical function whose gradient determines the force driving a system toward stable states, analogous to an energy surface.
Relaxation Time (τ_{relax})	The characteristic time required for a system to return to equilibrium after a perturbation.
Saddle Node Bifurcation	A bifurcation where a stable and an unstable fixed point collide and annihilate each other.
Tipping Point	A critical threshold where a small change in a parameter causes a rapid, often irreversible transition to a qualitatively different system state.
Time Irreversibility (ΔCC)	A measure quantifying asymmetry between forward and backward processes in time, indicating non-equilibrium behavior and serving as an early warning signal.
Transcritical Bifurcation	A bifurcation where two fixed points (one stable, one unstable) exchange stability as a parameter changes.