

Thermodynamic Formalism and Dynamical Systems — Reading Guide

This guide lists key books and papers exploring the **thermodynamic parallelism** between statistical mechanics and chaotic dynamical systems. It includes classic mathematical references as well as physically oriented introductions, organized by style and depth.

Foundational / Classic Texts

- David Ruelle – *Thermodynamic Formalism: The Mathematical Structures of Equilibrium Statistical Mechanics* (Cambridge, 1978). The seminal text introducing pressure, equilibrium states, and the variational principle.
- Ya. G. Sinai – *Introduction to Ergodic Theory* (Princeton, 1976). The ergodic roots of the thermodynamic analogy.
- Rufus Bowen – *Equilibrium States and the Ergodic Theory of Anosov Diffeomorphisms* (Springer LNM 470, 1975). Rigorous development for hyperbolic systems.

Conceptual & Intuitive Introductions

- A. Katok & B. Hasselblatt – *Introduction to the Modern Theory of Dynamical Systems* (Cambridge, 1995). Comprehensive reference linking entropy, pressure, and Lyapunov exponents.
- Pierre Collet & Jean-Pierre Eckmann – *Concepts and Results in Chaotic Dynamics: A Short Course* (Springer, 2006). Strong physical intuition and statistical viewpoint.
- J.-P. Eckmann & D. Ruelle – *Ergodic Theory of Chaos and Strange Attractors* (Rev. Mod. Phys., 1985). Classic review bridging physics and ergodic theory.

Fractals, Dimension, and Thermodynamic Analogy

- K. Falconer – *Fractal Geometry: Mathematical Foundations and Applications* (Wiley, 2014). Chapter 9 introduces thermodynamic formalism in fractal dimension theory.
- Hans-Otto Peitgen, Hartmut Jürgens, Dietmar Saupe – *Chaos and Fractals: New Frontiers of Science* (Springer, 2004). Visual and intuitive treatment of the thermodynamic analogy.

More Advanced / Specialized Sources

- Mark Pollicott & Michiko Yuri – *Dynamical Systems and Ergodic Theory* (Cambridge, 1998). Rigorous exposition of pressure, variational principles, and equilibrium measures.
- Denker, Grillenberger & Sigmund – *Ergodic Theory on Compact Spaces* (Springer, 1976). Early, influential text formalizing topological pressure.

For Physicists / Chaos Researchers

- Start with: Eckmann & Ruelle (1985) and Collet & Eckmann (2006).
- Then proceed to: Ruelle (1978) and Katok & Hasselblatt (1995) for a deeper mathematical understanding.

Suggested Reading Path

- 1. Eckmann & Ruelle (1985) — conceptual overview.
- 2. Ruelle (1978) — formal development of thermodynamic formalism.
- 3. Katok & Hasselblatt (1995) — entropy and Lyapunov exponents rigorously connected.
- 4. Falconer (2014) — application to fractal dimension and geometry.