Heat-flow operators, generators and finite spectral families — review sheet

Use this after attempting the worked examples and practice. Explain each claim in words before calculating.

Key ideas

- A function and its sampled vector are different objects.
- Generators, flows and observables answer different questions.
- A dataset split must match the desired generalization unit.
- An exact synthetic reference allows targeted numerical checks.

Common errors and repairs

Calling any fixed-size regression a universally transferable operator. State the tested family and discretizations.

Splitting snapshots or nodes from one case across sets. Group by the scientific unit intended to be unseen.

Retrieve without your notes

- What does the zero-frequency heat mode do?
- Does semigroup consistency establish biological validity?

Readiness check

- Distinguish a field, its samples, a scalar observable, a generator and a solution map.
- Specify an operator-learning problem with its domain, parameters, boundary conditions and prediction horizon.
- Construct complete-case train/test regimes and identify unsupported distribution changes.
- Check a simple diffusion operator against analytic and discrete references.