A reduced cardiac reaction–diffusion wave — review sheet

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

Key ideas

- The reduced cardiac model uses scaled voltage and a recovery gate, not the neuronal HH state.
- Shared-face diffusion cancels internally under sealed boundaries.
- Only diffusion conserves the stated voltage integral; reaction and stimulus change it.
- Physical stimulus overlap and interpolated sensor coordinates keep refinement experiments consistent.
- Component verification and active-wave sensitivity answer different questions.

Common errors and repairs

Reporting scaled voltage as millivolts without a conversion. Keep the dimensionless axis or explicitly state and justify a voltage scale.

Treating a missing arrival as zero speed. Report the observation window and undefined two-sensor speed.

Changing both mesh and time step and assigning an error order from one table. Separate the controls and use an appropriate reference or qualified successive-difference comparison.

Retrieve without your notes

- What are the units of D here?
- Why can backward-Euler diffusion preserve constants?
- What is one cm/ms in m/s?
- What extra evidence is needed for biological validation?

Readiness check

- Write the scaled two-current cardiac reaction equations with explicit units and limitations.
- Derive sealed-strand diffusion as a shared-face flux balance.
- Implement a threshold-crossing interpolation and convert a two-sensor delay into speed.
- Separate rest, diffusion conservation, gate admissibility and numerical accuracy checks.
- Compare spatial and temporal refinement at fixed physical sensor and stimulus locations.