Implicit pressure equations and ideal-valve complementarity — review sheet

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

Key ideas

- Differentiate or discretize stored CP when compliance varies.
- An active link adds a symmetric conductance block to the pressure matrix.
- A fixed valve guess creates a linear solve; consistency remains to be checked.
- Conservation alone cannot select the correct valve state.
- An independent constant-compliance reference reveals time error.

Common errors and repairs

Replacing the volume derivative with C times pressure derivative while C changes. Retain P times compliance derivative, or directly difference CP.

Clipping valve flow after solving once. Change the valve state and solve its new coupled balance.

Calling a conserved implicit result exact. Compare the same problem under refinement and with an independent reference.

Retrieve without your notes

- What units must h/R have in the pressure matrix?
- What happens to the active conductance terms when all compartment balances are summed?
- Can both open and closed labels describe the same state at zero pressure difference?

Readiness check

- Derive the changing-compliance volume balance without dropping the compliance derivative.
- Assemble a backward-Euler pressure system for a fixed valve-state guess.
- Trace a concrete rejected closed guess and accepted open solve.
- Check conservation, valve complementarity, units and time-step sensitivity separately.
- Implement a two-compartment matrix in a guided scaffold and connect it to the six-compartment method.