

Engineering Project 5: Thermal Stack Transient Temperature Solver

Problem statement

- Implement a fast, physics-based solver to predict transient temperature response across multilayer thermal stacks commonly found in semiconductor tools and packages.

The problem this project solves

- Full 3D thermal simulations are often too slow for early design iteration and process exploration.
- Engineers need rapid insight into interface temperatures, thermal time constants, and layer-dominant resistances without sacrificing physical accuracy.
- This project provides a lightweight, interpretable alternative for transient thermal analysis.

Applications

- Heater and chuck design evaluation for warm-up and cooldown behavior.
- Thermal sensitivity studies for material, thickness, and stack-up changes.
- Estimation of critical interface temperatures to support process window definition.
- Early-stage screening before committing to detailed multiphysics simulations.

Why it's important

- Accelerates design and process decisions by reducing simulation turnaround time.
- Improves thermal robustness by identifying dominant heat-transfer bottlenecks early.
- Enables scalable, repeatable thermal analysis as system complexity and design variants increase.