

# Heat Transfer Validation Lab

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## 1 Objective

Evaluate model accuracy for transient heat response under controlled boundary conditions.

## 2 Setup

A metal rod is instrumented with four thermocouples at equal distances. Heating is applied at one boundary for 120 seconds, followed by passive cooling.

## 3 Procedure

1. Calibrate sensors and record baseline.
2. Apply heat source at constant power.
3. Capture readings at 1-second resolution.
4. Repeat three runs and average.

## 4 Observations

| Probe | Peak (°C) | Time to peak (s) |
|-------|-----------|------------------|
| P1    | 79.2      | 34               |
| P2    | 68.5      | 51               |
| P3    | 58.7      | 74               |
| P4    | 49.9      | 93               |

Table 1: Representative averaged results.

## 5 Error Analysis

Major uncertainty sources include sensor contact quality and ambient airflow fluctuations. Combined uncertainty is estimated at  $\pm 1.4^\circ\text{C}$ .

## 6 Conclusion

The measured propagation profile agrees with the theoretical diffusion trend, with largest residuals near boundary transitions.