

NAFEMS P18 T4: two-dimensional heat transfer with convection

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1 Objective

Verify two-dimensional steady conduction with convection boundaries using Test T4 of *The Standard NAFEMS Benchmarks* [1]. The study compares a body-fitted Coreform/ Abaqus IGA solution with the published target.

2 Geometry

The domain is 0.6 m wide, 1.0 m high, and 0.05 m thick. Point E is located at $(x, y) = (0.6, 0.2)$ m. Insulated front and back faces preserve the two-dimensional response.

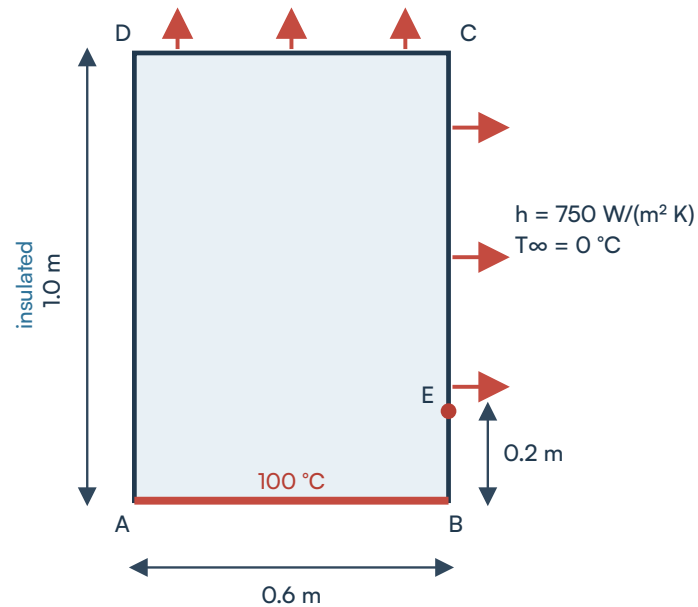


Figure 1: Geometry and thermal boundary conditions for NAFEMS P18 T4.

3 Material

The isotropic thermal conductivity is $k = 52 \text{ W / (m K)}$.

4 Loading & boundary conditions

The bottom edge AB is held at 100° C , and the left edge AD is insulated. The top and right edges exchange heat with a 0° C environment using $h = 750 \text{ W / (m}^2 \text{ K)}$.

5 Mesh & discretization

The Coreform/Abaqus model uses a body-fitted $12 \times 20 \times 1$ mesh with linear, C^0 splines.

Body-fitted simulation mesh (12×20×1)

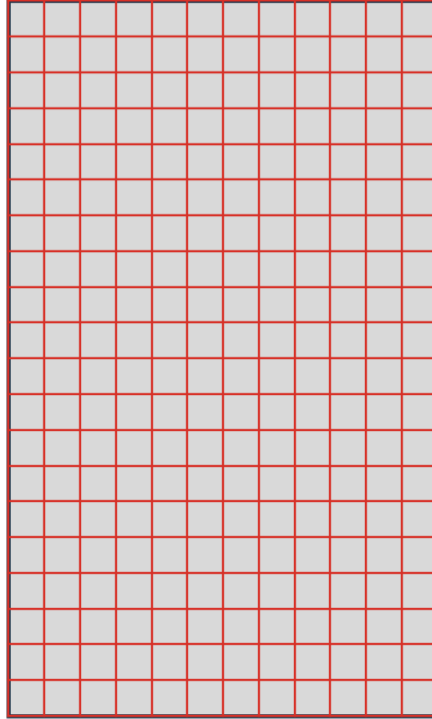


Figure 2: Exact body-fitted mesh used by the Coreform T4 simulation.

6 Reference & accepted solutions

The accepted temperature at E is 18.3 ° C [1]. The automated Coreform/Abaqus test enforces a 3% relative-error limit.

7 Results

7.1 Temperature at point E

Table 1: NAFEMS P18 T4 verification results.

Discretization	T_E (°C)	Relative error	Limit
Body-fitted Coreform/Abaqus IGA	18.08995	1.148%	3%

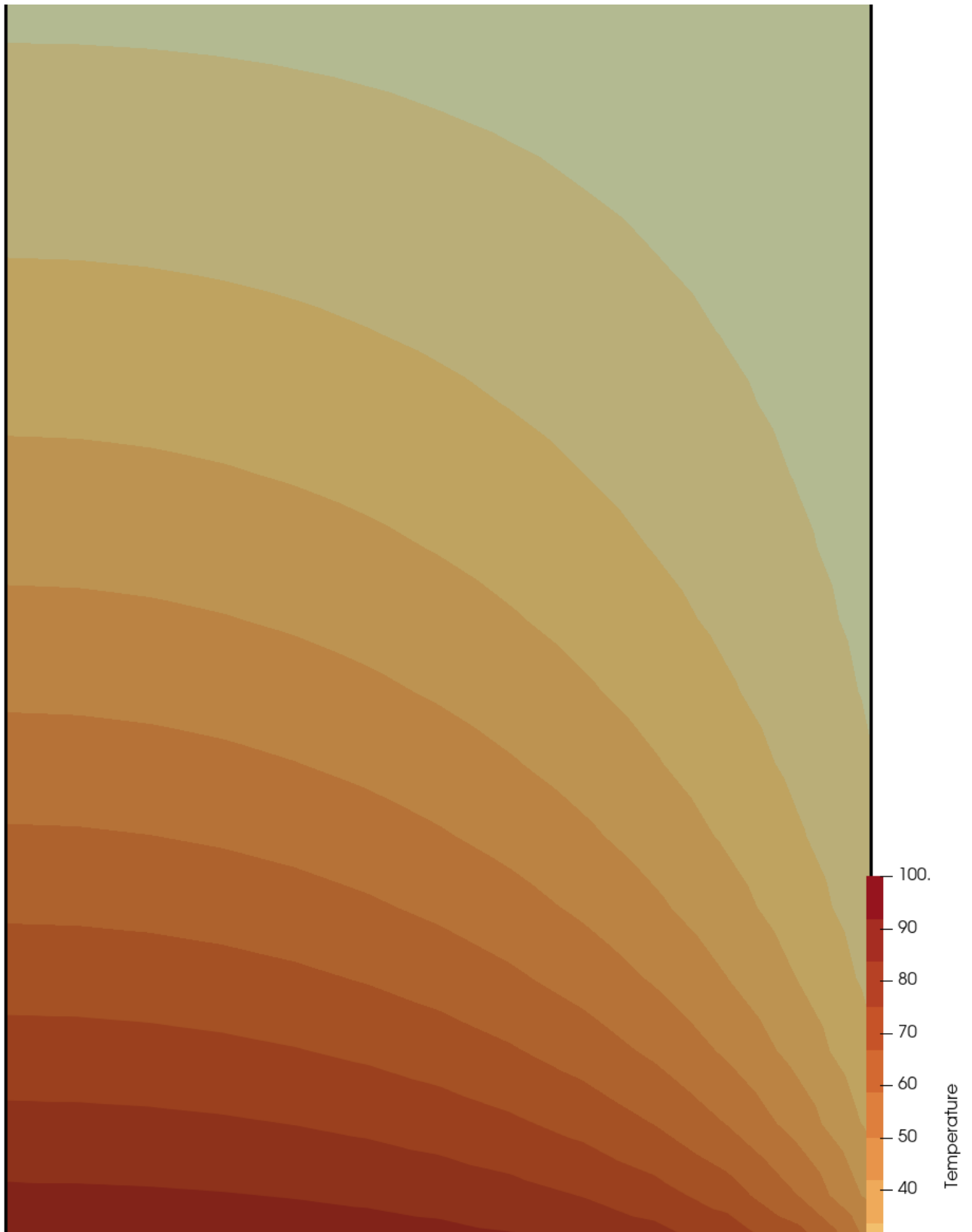


Figure 3: Coreform temperature field for NAFEMS P18 T4.

8 Discussion

The result satisfies the published target and verifies steady two-dimensional conduction and convection on a body-fitted spline discretization.

References

[1] *The standard NAFEMS benchmarks.* NAFEMS.

Appendix

8.1 Download artifacts

Download artifacts are available from the HTML version of this page.

8.1.a Geometry CAD files

Geometry CAD downloads are available from the HTML version of this page.

8.1.b Abaqus/CAE journal files

Individual journal downloads are available from the HTML version of this page.

8.2 Provenance

The record below identifies the Coreform/Abaqus verification evidence used by this page.

i Test_abaqus_verification_nafems_p18_t4

Parameter	Value
Evidence type	Numerical verification
CTest result	Passed (Release)
Verification result	Passed — 1/1 enforced criterion passed
Test date	10-Sep-2026 16:03:33
Operating system	Ubuntu 22.04.4 LTS
Coreform IGA version	2026.9+69838
Source revision	d88163e59ac0
Abaqus version	Abaqus 6.26-4