

NAFEMS P18 T2: one-dimensional heat transfer with radiation

Table of contents

1 Objective	1
2 Geometry	1
3 Material	2
4 Loading & boundary conditions	2
5 Mesh & discretization	2
6 Reference & accepted solutions	2
7 Results	3
7.1 Temperature at point B	3
8 Discussion	3
References	3
Appendix	3
8.1 Download artifacts	3
8.1.a Geometry CAD files	3
8.1.b Abaqus/CAE journal files	3
8.2 Provenance	4

1 Objective

Verify steady one-dimensional conduction coupled to nonlinear radiation using Test T2 of *The Standard NAFEMS Benchmarks* [1]. The study compares a body-fitted Coreform/ Abaqus IGA solution with the published target.

2 Geometry

The rod has length $L = 0.1$ m. Its square cross-section is a convenient three-dimensional representation; insulated lateral surfaces make the solution one-dimensional.

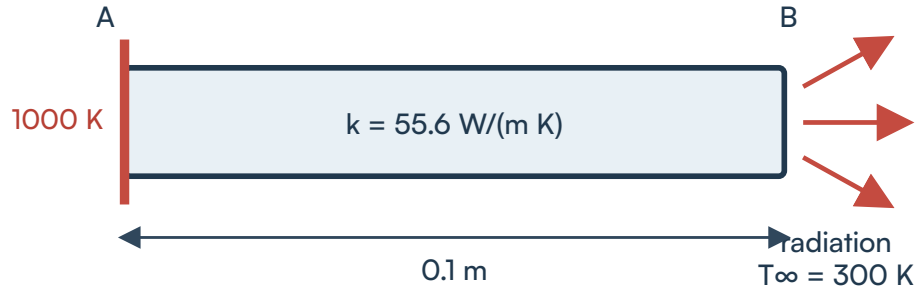


Figure 1: Geometry and thermal boundary conditions for NAFEMS P18 T2.

3 Material

The thermal conductivity is $k = 55.6 \text{ W / (m K)}$. The specified density and specific heat do not affect this steady solution.

4 Loading & boundary conditions

End A is held at $T_A = 1000 \text{ K}$. End B radiates to surroundings at $T_\infty = 300 \text{ K}$ according to

$$q = \epsilon \sigma (T_B^4 - T_\infty^4),$$

where $\epsilon = 0.98$ and $\sigma = 56.7 \times 10^{-9} \text{ W / (m}^2\text{K}^4\text{)}$.

5 Mesh & discretization

The Coreform/Abaqus model uses a body-fitted $10 \times 1 \times 1$ mesh with linear, C^0 splines.

Body-fitted simulation mesh ($10 \times 1 \times 1$)



Figure 2: Exact body-fitted mesh used by the Coreform T2 simulation.

6 Reference & accepted solutions

The accepted temperature at B is 927 K [1]. The automated Coreform test enforces a 1% relative-error limit.

7 Results

7.1 Temperature at point B

Table 1: NAFEMS P18 T2 verification results.

Discretization	T_B (K)	Relative error	Limit
Body-fitted Coreform/Abaqus IGA	927.00323	0.000%	1%

Figure 3: Coreform temperature field for NAFEMS P18 T2.

8 Discussion

The result agrees with the accepted endpoint temperature and verifies conduction and nonlinear radiation in the steady heat-transfer formulation.

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_t2

Parameter	Value
Evidence type	Numerical verification
CTest result	Passed (Release)
Verification result	Passed — 1/1 enforced criterion passed
Test date	10-Sep-2026 16:03:46
Operating system	Ubuntu 22.04.4 LTS
Coreform IGA version	2026.9+69838
Source revision	d88163e59ac0
Abaqus version	Abaqus 6.26-4