1 Versió 1 (la més recent)

Pregunta 1

Resposta desada

Puntuat sobre 10,00

We wish to study how the temperature varies with depth in a swimming pool. For that, we take a vertical segment from the bottom to the surface at the pool midpoint, and mesh it with 3 linear elements of equal length as shown in the image.

The water temperature follows the 1D Poisson equation $-k_c \frac{d^2T}{dx^2} = f(x)$, where k_c is the thermal conductivity of water, which we approximate as $0.5\frac{W}{mC}$, and the internal heat source is the warming of the pool by sunlight, with a power density $f(x) = (6x + 3)W/m$ (x is the height above the pool bottom in m). The pool bottom is always at a temperature $T_1 = 18C$, and the temperature at the pool surface has been measured to be $T_4 = 26C$.

(a) (2 points) The trace of the stiffness matrix K of the global system is

- 7
- Leave it empty (no penalty)
- 8
- 9
- 6 ✓

(b) (4 points) Find the load vector coefficient $F(3)$ exactly (do not approximate f as constant in the elements).

- 6.5
- 3
- Leave it empty (no penalty)
- 2.8125
- 4.5 ✓

Hint: the other coefficients of F are $F(1) = 1, F(2) = 3, F(4) = 2.75$.

(c) (4 points) With the given boundary conditions and values of F, and assuming no convection, find the maximal water temperature among the nodes n_1, n_2, n_3, n_4.

- 32
- 26
- 24.1667
- Leave it empty (no penalty)
- 27.3333 ✓

Hint: $Q_1 = -7.1667$.

Torna a començar | Desa | Emplena amb les respostes correctes | Envia i acaba | Tanca la previsualització

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