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Versió 1 (la més recent)

Pregunta 1

Resposta desada

Puntuat sobre 10,00

In an electric stove, electrical current circulates through a metal coil, which warms due to electric resistance. The stove incorporates an air vent to force convection inside the coil.

The figure shows a section of the metal coil, and the file **curved_strip.m** contains a meshing of this domain using quadrangular elements (lengths in *cm*).

The boundary of the domain has 4 sides: 2 straight ones where $x = 0$, $y = 2$, respectively, and 2 curved sides of which the top one is internal to the coil, and the bottom one is external. To detect the nodes of the upper curved side, the following procedure is suggested (but is not mandatory): Firstly, detect all the domain nodes below the line, that is, fulfilling $2.9x - 4.9y - 4.41 > 0$, and join them with the nodes of the two straight sides. Secondly, detect all the boundary nodes, and subtract them from all the nodes found in the first step. You will reach the upper curved side. With this you will obtain already easily the lower curved side also.

The heat conductivity of the material is $k_c = 0.05 \frac{W}{cmC}$. Its electric resistance generates an internal power heating (f) at a homogeneous rate of $0.033 \frac{W}{cm^2}$. There is no heat flow across the straight lines in the boundary, and there is convection heat flow on the two curved sides of the boundary, with convection coefficients $\beta = 3 \cdot 10^{-3} \frac{W}{cm^2C}$ on the internal side and $\beta = 5 \cdot 10^{-4} \frac{W}{cm^2C}$ on the external side. The temperature of the medium is $T_\infty = 60C$ on the internal side and $T_\infty = 20C$ on the external side. Assume no convection in the nodes at the 4 corners.

(a) (3 points) The sum of the x-coordinates of the points belonging to the top curved boundary is .

- ☐ Leave it empty (no penalty)
- ☐ 4.3737e+01
- ☐ 5.6913e+01
- ☐ 1.5139e+02
- ☒ 9.4185e+01

Hint: the sum of the y-coordinates is 3.7160e+01

(b) (4 points) Find the highest temperature in the domain.

- ☐ 67.1334
- ☐ 67.0552
- ☒ 67.2991
- ☐ 67.2577
- ☐ Leave it empty (no penalty)

Hint: Node 117 has temperature 67.1826C.

(c) (3 points) Count how many elements have a temperature $T > 67.17C$ in their barycenter.

- ☐ 145
- ☐ 515
- ☐ 525
- ☐ Leave it empty (no penalty)
- ☒ 124

Hint: 201 elements have a temperature lower than 67.12C in their barycenter.

Torna a començar

Desa

Emplena amb les respostes correctes

Envia i acaba

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