Heat conduction in a thin rod

This text is integrating part of the homonymous link in PEEI: a computer program for the numerical solution of systems of partial differential equations.

Coordinate system: Cartesian

System of measurement: International System of Units

Coordinates of Cartesian system: $\underline{x}_v$ of which $\underline{x}_v \equiv \{x,y,z\}$ $[x]\equiv[y]\equiv[z]\equiv$[length] $\Re\langle x\rangle\equiv\Re\langle y\rangle\equiv\Re\langle z\rangle\equiv(-\infty,\infty)$

Unknown functions: $T(\underline{x}_v)$ of which $[T]\equiv$[temperature]

Differential analytic model: $\partial^2 T(\underline{x}_v)/\partial x^2+\partial^2 T(\underline{x}_v)/\partial y^2+\partial^2 T(\underline{x}_v)/\partial z^2=0$

Definition set: $\{\underline{x}_v / x_1\leq x\leq x_2; y_1\leq y\leq y_2; z_1\leq z\leq z_2\}$ $x_1=y_1=z_1=0$ $x_2=100$ $y_2=z_2=1$.

Conditions: $T(x_1,y,z)=T(x_2,y,z)=1000$ $K\cdot(\partial T(x,y_1,z)/\partial y)-H\cdot(T(x,y_1,z)-T_\infty)=K\cdot(\partial T(x,y_2,z)/\partial y)+H\cdot(T(x,y_2,z)-T_\infty)=K\cdot(\partial T(x,y,z_1)/\partial z)-H\cdot(T(x,y,z_1)-T_\infty)=K\cdot(\partial T(x,y,z_2)/\partial z)+H\cdot(T(x,y,z_2)-T_\infty)=0$ $K=20$ $H=50$ $T_\infty=0$

Solution in [1]: $T(\underline{x}_v)\equiv(T(x_1,y,z)\cdot\sinh(\mu\cdot(L-x))+T(x_2,y,z)\cdot\sinh(\mu\cdot x))/\sinh(\mu\cdot L)$ $\mu^2\equiv4\cdot H/K$ $L\equiv x_2-x_1$

Related files: mad.txt

Case 1:
Related files: points_1.txt, PEEI_mem_1.bin, cond_1.txt, PEEI_sol_1.txt, plot_1.jpg

Case 2:
Related files: points_2.txt, PEEI_mem_2.bin, cond_2.txt, PEEI_sol_2.txt, plot_2.jpg

Case 3:
Related files: points_3.txt, PEEI_mem_3.bin, cond_3.txt, PEEI_sol_3.txt, plot_3.jpg

Case 4:
Related files: points_4.txt, PEEI_mem_4.bin, cond_4.txt, PEEI_sol_4.txt, plot_4.jpg

Case 5:
Related files: points_5.txt, PEEI_mem_5.bin, cond_5.txt, PEEI_sol_5.txt, plot_5.jpg

Case 6:
Related files: points_6.txt, PEEI_mem_6.bin, cond_6.txt, PEEI_sol_6.txt, plot_6.jpg

Case 7:
Related files: points_7.txt, PEEI_mem_7.bin, cond_7.txt, PEEI_sol_7.txt, plot_7.jpg

Case 8:
Related files: points_8.txt, PEEI_mem_8.bin, cond_8.txt, PEEI_sol_8.txt, plot_8.jpg

Case 9:
Related files: points_9.txt, PEEI_mem_9.bin, cond_9.txt, PEEI_sol_9.txt, plot_9.jpg

Case 10:
Related files: points_10.txt, PEEI_mem_10.bin, cond_10.txt, PEEI_sol_10.txt, plot_10.jpg

Bibliography:
[1] H. S. CARSLAW, J. C. JAEGER, *Conduction of Heat in Solids*, second edition, Oxford University Press, 1986, London.