

CS 152 SciML Assignment 2 Part 1

Due Oct 8

For the 2D model of heat conduction we discussed in class:

$$\rho c \frac{\partial T}{\partial t} = \frac{\partial}{\partial x} \left(k \frac{\partial T}{\partial x} \right) + Q.$$

$$T(0,y)=T(1,y)=0; 0 < t < t_f; 0 < x < 1.5, 0 < y < 1.0$$

The solution for this partial differential equation model representing transient *temperatures in the plate* under conductive heat transfer can be obtained using a Galerkin projection on to $v \in V = \{\text{piecewise linear polynomials with } C^0 \text{ continuity}\}$ – see code attached.

- If parameters $k=0.1, 1.0, 10.0$, $t_f=0.1, 0.2, 0.5$ plot the temperature field $T(x,y,t_f)$.
Please sample $T(x,y,t)$ at 10 randomly chosen points and plot $T(t)$ at each site.
- Please fit regressions with algebraic and trigonometric polynomials
 $\sum_{m=1}^5 \sum_{n=1}^5 a_{mn} \sin(m 2\pi x/1.5) \sin(n 2\pi y)$ to $T(x,y,t_f)$.
- Please construct simple linear and non-linear regression models for $T(t)$.
- Sketch ideas for building space-time models for the “data” and try to build a model for the 10 points of data for which you have $T(x,y,t)$ used in a).**