Test 1: Approximating The Heat Equation

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Abstract

For this assignment, we were tasked with approximating The Heat Equation, $u_t = u_{xx}, (0 < x < 1, t > 0)$ with given boundry conditions $u(0,t) = u(1,t) = 0$ and initial condition $u(x,0) = sin(\pi x)$ using methods dicussed in class. We were also asked to graph the exact soluition.

1 An Anylitical Solution

Using the method of *Seperation of Variables*, the general solution the The Heat Equation with the given initial conditions and boundry conditions is

$$u(x,t) = e^{-(\pi)^2 t} sin(\pi x) \tag{1}$$

below is a graph of $u(x,t)$ for $t = 0, .025, .1,$ and $.5$

2 A Computational Solution

The Forward-Time Central-Space (FTCS) scheme was used to appoximate the Solition to the PDE with MatLab. Below is a graph of the solition generated by this scheme.