DG

January 5, 2020

This repositary contains the solution to the coding homework for APMA 2810 Discontinuous Galerkin Methods by Prof. Chi-Wang Shu. Below is a description of these homeworks(including 1 take-home exam). The written homework is not included here.

0.0.1 HW1

Use DG to find the solution to the following equation:

$$\begin{cases} u_x = \cos x, & 0 \le x \le 1 \\ u(0) = 0 \end{cases} \tag{1}$$

and plot L_1, L_2, L_∞ error tables.

0.0.2 HW2

Use DG to find the solution to the following equation with two different initial conditions on $[0, 2\pi] \times [0, 2\pi]$:

$$\begin{cases} u_t + u_x = 0, \\ u(x, 0) = \sin(x) \end{cases} \tag{2}$$

$$\begin{cases} u_t + u_x = 0, \\ u(x, 0) = 1, & x \in (\frac{\pi}{2}, \frac{3\pi}{2}) \\ u(x, 0) = 0, & x \in (0, \frac{\pi}{2}) \cup (\frac{3\pi}{2}, 2\pi) \end{cases} \tag{3}$$

and plot L_1, L_2, L_∞ error tables.

0.0.3 HW3

Plot moment error tables of the problem last week.

0.0.4 HW4

Apply TVD limiter and TVB limiter with $M = 0.1$, 1, 5, 10 to the problem in week 2. Plot error tables and report the points changed by the limiters.

0.0.5 HW5

Apply Bound Preserving Limiter to the problem in week 2. Plot error tables.

0.0.6 HW6

Use LDG with central flux and alternating flux to find the solution to the following equation on $[0, 2\pi] \times [0, 1]$:

$$\begin{cases} u_t = u_{xx}, \\ u(x, 0) = \sin(x) \end{cases} \tag{4}$$

and plot L_1, L_2, L_∞ error tables.

0.0.7 HW7

Use Bauman-Oden, SIPG and Ultra-Weak scheme to solve the problem last week and plot error tables.

0.0.8 HW8

Use LDG to find the solution to the following equation on $[0, 2\pi] \times [0, 1]$:

$$\begin{cases} u_t = u_{xxx}, \\ u(x, 0) = \sin(x) \end{cases} \tag{5}$$

and plot L_1, L_2, L_∞ error tables.

0.0.9 HW9

Use Ultra-weak scheme to solve the problem last week and plot error tables.

0.0.10 Final Exam

Use LDG to find the solution to the following two equations on $[0, 2\pi] \times [0, 1]$:

$$\begin{cases} u_t + u_x = \epsilon u_{xx}, \\ u(x, 0) = \sin(x) \end{cases} \tag{6}$$

$$\begin{cases} u_t + u_x = \epsilon u_{xxx}, \\ u(x, 0) = \sin(x) \end{cases} \tag{7}$$

and plot L_1, L_2, L_∞ error tables.

[0]: