

Numerical Partial Differential Equations II

Discontinuous Galerkin Methods

Homework 1

(Due: Apr 11, 2005)

Consider the initial value problem,

$$\frac{d}{dt}u = f(t)u(t), \quad t \in (0, 2), \quad u(0) = u_0.$$

Write a code to solve the initial value problem using Discontinuous Galerkin methods with Legendre polynomials as basis functions.

1. Solve the problem with various grid size and

$$f(t) = e^t, \quad u_0 = 1$$

- Compute the L^2 -errors of the numerical solutions. What is the rate of convergence?
- Compute the Nodal errors of the numerical solutions. What is the rate of convergence?
- Discuss the results.

2. Solve the problem with various grid size and

$$f(t) = \begin{cases} t & 0 \leq t \leq 1 \\ e^{t-1} & 1 < t < 2 \end{cases} \quad u_0 = 1$$

- Compute the L^2 -errors of the numerical solutions. What is the rate of convergence?
- Compute the Nodal errors of the numerical solutions. What is the rate of convergence?
- Discuss the results.