DG Maxwell Documentation

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Aman Abhishek Tiwari, Balavarun P., and Manichandra Morunpud

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Introduction

This projects aims at developing a fast Maxwell's Equation solver using the discontinuous Galerkin method. As first steps to develop this solver, we are developing a library which allows us to solve the 1D wave equation and the 2D wave equation using discontinuous Galerkin method.

1.1 1D Wave Eqaution Solver

The 1D wave equation solver is aimed at finding the time evolution of the 1D wave equation using the discontinuous Galerkin method. The 1D wave equation is given by the equation:

$$\frac{\partial u}{\partial t} + \frac{\partial F}{\partial x} = 0 \tag{1.1}$$

where,

$u \equiv u(x, t)$

$F(u) = cu$

where c is the wave speed.

1.2 2D Wave Equation Solver

The 2D wave equation solver is aimed at finding the time evolution of the 2D wave equation using the discontinuous Galerkin method. The 2D wave equation is given by the equation:

$$\frac{\partial u}{\partial t} + \vec{\nabla} \cdot \vec{F} = 0 \tag{1.2}$$

where,

$u \equiv u(x, y, t)$

$\vec{F} = \vec{c}u$

$$\vec{c} = c_0\hat{i} + c_1\hat{j}$$

where, c_0 and c_1 denotes the component of the wave speed in the $\hat{i}$ and $\hat{j}$ direction respectively.

Through the development of the 2D wave equation solver, the code and the algorithms developed here will help in creating the 2D Maxwell's equation solver. Currently the 2D wave equation solver will focus on solving the wave equation in a rectangular domain in the (x, y) plane, with periodic boundary conditions.

$$\vec{c} = c_0\hat{i} + c_1\hat{j}$$

Submodules

utils	Utility functions like add, linspace etc.
lagrange	Functions related to Lagrange polynomials, LGL_points.
msh_parser	Functions for parsing the **.msh** files and plotting meshes.
isoparam	Functions for isoparametric mapping.
wave_equation	Functions related to time_evolution of 1D wave equation.

Introduction

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3.1 1D Wave Eqaution Solver

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$F(u) = cu$

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