MATH 521 Project Proposal

Jincong Li 60539939

Mar 2nd

1 Introduction

This project proposes a comprehensive look into Weak Galerkin (WG) finite element method for the Navier–Stokes equations. It aims to study another finite element method other than the topics covered in the course but with same approach of exploring. The project will delve into the methodology, findings, and implications of applying the Weak Galerkin (WG) Finite Element Method to solve the Navier-Stokes equations, which are fundamental in describing fluid motion as well as in more advanced fields, such as Fluid Structure Interaction (FSI).

2 Objectives

The objectives of this project follows the general structure of the course material as how we explore a FEM.

- Understand the WG Finite Element Method's development (scheme) and its application to the Navier-Stokes equations.

- Discuss the existence and uniqueness of the WG Finite Element Method's solution.

- Perform the error estimate and analysis of the WG Finite Element Method.

- Evaluate the method's effectiveness (convergence rate), and computational efficiency.

3 Methodology

The project will start from reviewing relevant articles and then presenting a summary with personal understanding of the article's contributions. Moreover, a comparison with the finite element methods covered in course material could be conducted and analyzed.

4 Expected Outcomes

The project aims to clarify the WG Finite Element Method's contributions to computational fluid dynamics, discussing its strengths, limitations, and future research directions. It will also provide insights into the method's engineering applications, such as FSI mentioned previously.