MODELING AND USE OF FEM ON STATIC STRUCTURE

A SECOND YEAR PROJECT REPORT

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF B.Sc. IN COMPUTATIONAL MATHEMATICS

BY

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April, 2022

CERTIFICATION

This project entitled "Modeling and use of FEM on static structure" is carried out under my supervision for the specified entire period satisfactorily, and is hereby certified as a work done by following students

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Date:April 16, 2022

APPROVED BY:

I hereby declare that the candidate qualifies to submit this report of the Math Project (MATH-252) to the Department of Mathematics.

Head of the Department
Department of Natural Sciences
School of Science
Kathmandu University
Date:April 16, 2022

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Your parameters here.

CHAPTER 1

MOTIVATION/INTRODUCTION

1.1 Context/Rationale/Background

In this section, the author(s) shall discuss the historical background related to the work along with the introduction of the topic in brief.

1.2 Objectives

1. **To set up differential equations with variable boundary conditions.**
2. **To learn to perform numericals manually and then implement those in a high level programming language**
3. **To learn about FEM, its variations, and its application to various mechanical problems.**
4. **Visualization and Project Writing.**

1.3 Significance/Scope

The use of numerical methods is prevalent in all fields of science and technology today. Our project focuses on one powerful numerical tool known as FEM which is theoretically sound and computationally efficient. The basic ideas of such tools which one is sure to encounter later will be very beneficial. This project also opens up the world of variational calculus and its applications which are generally not covered in undergraduate mathematics.

The computer implementation of a package that implements the algorithm for solving problem using FEM while handling inputs and visualizing the output is a stark contrast from the dummy math problem that are usually used in computer programming classes to teach concepts of general programming rather than mathematical programming. This project imparts the skill to convert mathematical knowledge into efficient and all around packages that solve problems that are based on real world applications and are similar to ones encountered later at work in industries or academia.

1.4 Limitations

The project only focuses on application of FEM to a single differential equation and thus despite being a great starting point for diving into the world of finite element method, it lacks behind in providing full demonstration of its potential. We have applied FEM to solve 2D truss structures. The computer implementation is also limited to this subset of problems and can work with only 2D trusses.

CHAPTER 2

METHODOLOGY/MODEL EQUATION

2.1 Theoretical/Conceptual Framework

In this section, the author(s) should describe the theoretical/mathematical principles behind the whole work relative to the project. The information collected from literature review shall be relevant in this section.

CHAPTER 3

RESULTS AND DISCUSSIONS

3.1 Result1

In this chapter, the author(s) shall present the results and simulations (in the form of numerical data or graphical form) of the theory described in CHAPTER-2 and finally discuss the results.

CHAPTER 4

CONCLUSIONS

In this section, the author(s) shall summarize the main points and the results of the work. Include key facts from the background research to help explain your results as needed.

REFERENCES

[1] R. Doe, *Miktex url*, `http://www.miktex.org`, June 2009.

[2] K. C. Gokul, D. B. Gurung, and P. R. Adhikary, *Fem approach for one dimensional temperature distribution in the human eye*, Proceedings of National Conference on Mathematics (Kathmandu) (P. R. Adhikary, K. Jha, and C. Bhatta, eds.), Nepal Mathematical Society, 2012, pp. 35–46.

[3] D. B. Gurung, *Mathematical study of abnormal thermoregulation in human dermal parts*, PhD Dissertation, Kathmandu University, 2008, pp. 1–188.

[4] H. Kopka and P. W. Daly, *A guide to latex*, Addison-Wesley, Reading, MA, 1999.

[5] B. Roy, S. K. Roy, and D. B. Gurung, *Holling-Tanner model with Beddington-DeAngelis functional response and time delay introducing harvesting*, Mathematics and Computers in Simulation **142** (2017), 1–14.