

**UNIVERSITI TEKNOLOGI MARA**

**TECHNICAL REPORT**

**SOLVING BURGER-FISHER EQUATION (BFE) BY USING BANACH  
CONTRACTION METHOD (BCM)**

**FATEEN NURARIBAH BINTI AHMAD FADHLI 2021172863  
NURUL IZZAH ZAHRA BINTI SHAHRULANUAR 2021125549  
SAIDAHTUL IZYAN IZZATI BINTI MOHAMAD SAZALI 2021102463  
(P03S22)**

**Report submitted in partial fulfillment of the requirement  
for the degree of  
Bachelor of Science (Hons.) (Mathematics)  
College of Computing, Informatics and Media**

**FEBRUARY 2023**

## **ACKNOWLEDGEMENTS**

First of all, we would like to express our sincere gratitude to the Almighty God for providing us with strength and His blessing, which allowed us to successfully complete this research. We do this in the name of Allah, the Most Gracious and the Most Merciful. We wouldn't get to the conclusion without His help and blessing. Furthermore, without the participation, effort, and outstanding teamwork of our team members, Fateen Nuraribah binti Ahmad Fadhli, Nurul Izzah Zahra binti Shahrulanuar, and Saidahtul Izyan Izzati binti Mohamad Sazali, this research cannot be finished. In order to produce an exceptional work with complete responsibility and dedication, we all gave it our very best effort.

Nevertheless, we would want to express our sincere gratitude to our supervisor, Dr. Mat Salim Bin Selamat, and our dedicated MSP660 lecturer, Dr. Zahari Bin Mohd Rodzi. It's because our research would not have been completed successfully without their leadership and insightful guidance. From the start of the semester until the end, they provided us with endless help and instructions on how to achieve the highest quality research results. Finally, we would like to express our gratitude to each and every one of our classmates as well as our families for their support and encouragement throughout this semester.

Last but not least, we want to thank ourselves for believing in ourselves. We want to thank ourselves for doing all this hard work and never quitting. We also want to thank ourselves for trying to do more and just being ourselves at all times.

# TABLE OF CONTENTS

<b>ACKNOWLEDGEMENTS</b> .....	<b>ii</b>
<b>TABLE OF CONTENTS</b> .....	<b>iii</b>
<b>LIST OF TABLES</b> .....	<b>iv</b>
<b>LIST OF FIGURES</b> .....	<b>iv</b>
<b>ABSTRACT</b> .....	<b>v</b>
<b>CHAPTER 1</b> .....	<b>1</b>
<b>INTRODUCTION</b> .....	<b>1</b>
1.1 Motivation .....	1
1.2 Problem Statement .....	2
1.3 Objectives.....	3
1.4 Significant and Benefit of Study .....	3
1.5 Scope and Limitation of Study .....	3
1.6 Research Organizations .....	3
<b>CHAPTER 2</b> .....	<b>5</b>
<b>BACKGROUND THEORY AND LITERATURE REVIEW</b> .....	<b>5</b>
2.1 Background Theory .....	5
2.2 Literature Review/ Related Research.....	5
<b>CHAPTER 3</b> .....	<b>11</b>
<b>METHODOLOGY AND IMPLEMENTATION</b> .....	<b>11</b>
3.1 The flowchart of solving Burger-Fisher Equation by using BCM.....	11
3.2 Banach Contraction Method (BCM) .....	15
3.3 Burgers-Fisher Equation .....	17
3.4 Implementations of BCM into Burger-Fisher Equation.....	18
<b>CHAPTER 4</b> .....	<b>19</b>
<b>RESULTS AND DISCUSSION</b> .....	<b>19</b>
<b>CHAPTER 5</b> .....	<b>33</b>
<b>CONCLUSIONS AND RECOMMENDATIONS</b> .....	<b>33</b>
<b>REFERENCES</b> .....	<b>35</b>
<b>APPENDICES</b> .....	<b>39</b>

**LIST OF TABLES**

Table 1: The error for  $\sigma = 1$  shows the differences between exact solution and BCM. 19  
Table 2: The error for  $\sigma = 1$  shows the differences between exact solution and BCM. 26  
Table 3: The error for  $\sigma = 0.01$  shows the differences between exact solution and BCM. 27

**LIST OF FIGURES**

Figure 1: The flowchart of solving Burger-Fisher Equation by using BCM ..... 11

## ABSTRACT

In this article, we propose a method for solving the Burger-Fisher equation. The proposed method is the Banach Contraction Method (BCM). The Burger-Fisher equation is a combination of the Burger equation and the Fisher equation. There have been many methods used to solve the problem associated with the Burger-Fisher Equation, such as the Adomian Decomposition Method (ADM) and the Local Discontinuous Galerkin (LDG) method. However, the computations of these methods use too much computer memory because the data to be processed is large. Therefore, this paper presents the results of the research findings with two main objectives: We used the BCM to solve the Burger-Fisher Equation, followed by validating the accuracy of the BCM with the exact solutions. Plus, in this study, calculations were mainly performed using the MAPLE 2018 software to facilitate the calculations and simplify the complicated results. As for the scope of this study, we cover the partial differential equation specifically in terms of the Burger-Fisher Equation and the BCM. In summary, the method used in this study has introduced a straightforward mathematical method for solving various differential equations, which improves and expands our knowledge in the field of mathematics. Currently, all the articles related to Burger-Fisher Equation and BCM are applicable in this study. Also, a procedure for implementing the method is provided, along with an error analysis. As a result, we calculate the exact solution of Burger-Fisher Equation using BCM up to  $u_1(x, t)$  only. As for  $u_2(x, t)$  and continuously the solution was too long thus, we provide the error between the exact solution and BCM by using various value of  $\alpha, \beta$ , and  $\sigma$  as for  $x$  from 0 to 1 and for  $t = 1, 10$ , and 50. We prove that the new technique is more practical by comparing the outcomes of the exact solution with certain previously reported findings. This study contributes to assisting society in the exact comprehension of a person's thoughts and discoveries. Since our society is developing a new level of education, and it is an excellent advancement, this study may reveal things that are not yet discovered, but as time goes on, this research may become the foundation for the advancement and expansion of education in our society. Therefore, hopefully, for the future project, the BCM can be applied and design efficiently and come out with an expected result. To succeed, further investigation and research must be done into that subject.