UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

NUMERICAL SOLUTION OF HEAT DISTRIBUTION IN CONVECTIVE OVEN BY USING ALTERNATING DIRECTION IMPLICIT METHOD

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Report submitted in partial fulfillment of the requirement for the degree of
Bachelor of Science (Hons.) Mathematics
Center of Mathematics Studies
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JUNE 2017

ACKNOWLEDGEMENTS

IN THE NAME OF ALLAH, THE MOST GRACIOUS, THE MOST MERCIFUL

Firstly, we are grateful to Allah S.W.T for giving us the strengths to complete this project successfully.

We would like to express our gratitude towards our supervisor, Sir Rahimie Bin Md. Noor and our Final Year Project (FYP) coordinator, Madam Wan Khairiyah Hulaini Binti Wan Ramli for the support and guidance throughout this final year project.

This project also cannot be done without the cooperation from our group members, Nurhanani Binti Saari, Khairunnisa' Binti Khairul Anwar and Nur Khairunnisa Binti Akhirruddin. We would also like to thank you to all lecturers, friends and families who always encouraged us in finishing this project.

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ABSTRACT

The convection oven baking was investigated with experimentally and numerically as a heat transfer process. The heat mechanism was defined by Fourier's Law and used the two-dimensional of mathematical model. The alternating direction implicit finite difference technique was used for the numerical solution of representative the model. The numerical solution then compared with the experimental which consider heat transfer only with constant thermal-physical properties. The nodes of the heat distribution of experimental and numerical are compared by using relative error.

1 INTRODUCTION

1.1 Research Backgroud

Convection oven is the simple way to cook food faster. The ovens can either heat the food that is being cooked from below or top. It is using a fan to circulate air and maintain the temperature more steady. "Convention current" of heat and air are at any oven since it is natural circulation of heat created by temperature differences but "convention" oven forces an even circulation of heat through use of its fan, so these ovens really ought to be called "forced convection ovens". Thus, these will help to bake food quickly and evenly. Otherwise, there are some food are not suitable using convection oven due to convection fan that will dry out quickly such as cookies and breads.

Baking is an intricate nature which changes in physically, chemically and biochemically, all at the same time. The quantitative comprehension of significant processes in baking is quite restricted. For instance, the temperate and technique of heating as well as the moisture content are in relation with the volume expansion, or oven rise (Zhang & Datta, 2006).

Simultaneous heat and moisture transfer was assumed to develop models for the baking process. The Fourier's equation of two dimensional for unsteady state heat conduction for solids with constant thermo-physical properties in a geometry of a finite cylinder can be amended by adding a phase that change term to account the vaporization of the moisture of product (Sakin et al., 2007b). A lot of heat transfer models use heat transfer coefficient, h between the surface of the product and its enclosing; since it is a required parameter (Carson et al., 2006). To manage this solution,the implicit alternating direction finite difference (ADI) technique was used followed by Gaussian Elimination.