ENTROPY ANALYSIS IN A CHANNEL FLOW WITH TEMPERATURE DEPENDENT VISCOSITY

BY

CYNTHIA REITUMETSE NDABA
[B.SC., B.SC HONS]

Submitted in fulfillment of the requirements for the degree of MASTER OF SCIENCE IN APPLIED MATHEMATICS,
School of Computational and Mathematical Sciences,
University of Limpopo, Private Bag X1106,
Sovenga 0727, South Africa

SUPERVISOR: Professor O. D. MAKINDE

SEPTEMBER 2007

DECLARATION

I declare that the dissertation hereby submitted to the University of Limpopo for the degree of Master of Science has not been submitted by me at this university or any other university and that this is my own work in design and in execution and all material contained therein has been duly acknowledged.

Signed:___________________________

Date:____________________________

CERTIFICATION

I certify that this work was carried out by **CYNTHIA REITUMETSE NDABA** under my supervision in the Applied Mathematics, University of Limpopo, Private Bag X1106, Sovenga 0727, South Africa.

Professor O. D. Makinde

Supervisor

DEDICATIONS

To my Mother, my Husband, my little boy Thato, my relatives and all my friends, I love you all.

ACKNOWLEDGEMENT

I would like to place on record my sincere gratitude to the following people who have contributed towards the successful completion of this research project: Prof. O.D Makinde for his supervision, immense support, patience and motivation. My mother Annah Ndaba and my husband Amulet Makhalemele for always being there for me during difficult times. Dr. P Mhone for his assistance especially with Maple problems. My friends at Turfloop for their patience and understanding and finally Dr. J Moitsheki for his support.

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ABSTRACT

The thermodynamic irreversibility in any fluid flow process can be quantified through entropy analysis. The first law of thermodynamics is simply an expression of the conservation of energy principle. The second law of thermodynamics states that all real processes are irreversible. Entropy generation is a measure of the account of irreversibility associated with the real processes. As entropy generation takes place, the quality of energy (i.e. exergy) decreases. In order to preserve the quality of energy in a fluid flow process or at least to reduce the entropy generation, it is important to study the distribution of the entropy generation within the fluid volume. In this dissertation, the inherent irreversibility in the flow of a variable viscosity fluid in both a closed channel and an open channel is investigated. The channel is assumed to be narrow, so that the lubrication approximation may be applied and the fluid viscosity is assumed to vary linearly with temperature. Both the lower and the upper surfaces of the channel are maintained at different temperature. The simplified form of governing equations is obtained and solved analytically using a perturbation technique. Expressions for fluid velocity and temperature are derived which essentially expedite to obtain expressions for volumetric entropy generation numbers, irreversibility distribution ratio and the Bejan number in the flow field.

In chapter 1, a historic background of the study is highlighted. Both closed and open channels problem are investigated in chapters 2 and 3. In chapter 4, generally discussion

on the overall results obtained from the investigation is displayed together with possible areas of future research work.