



شبكة المعلومات الجامعية

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ





شبكة المعلومات الجامعية



شبكة المعلومات الجامعية

التوثيق الالكتروني والميكرو فيلم

جامعة عين شمس

التوثيق الالكتروني والميكرو فيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأفلام قد اعدت دون أية تغيرات



يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of
15 – 25c and relative humidity 20-40 %



شبكة المعلومات الجامعية



بعض الوثائق الأصلية تالفة



شبكة المعلومات الجامعية



بالرسالة صفحات
لم ترد بالأصل



Ain Shams University.
Faculty of Education.
Department of Mathematics.

ELECTROHYDRODYNAMIC KELVIN-HELMHOLTZ INSTABILITY WITH HEAT AND MASS TRANSFER

Thesis

*Submitted in Partial Fulfillment of the Requirements of the Master's
Degree in Teacher Preparation in Science (Applied Mathematics)*

Submitted to:

**The Department of Mathematics
Faculty of Education - Ain Shams University**

By:

Emad Hassan Aly Farag
*B.Sc & Education (Mathematics)
Ain Shams University (1994).*

Under the Supervision of:

Prof. Dr. Abou Elmaged A. Mohamed
*Prof. of Applied Mathematics.
Faculty of Education, Ain Shams University.*

A A Mohamed

Dr. Mohamed F. Elsayed
*Lecturer of Applied Mathematics.
Faculty of Education, Ain Shams University.*

M.F. ElSayed

1999

B 9042

**To everyone taught me
anything,
No words can express my
thanks.**

ACKNOWLEDGMENTS

First of all, gratitude and thanks are to ALLAH who always helps and guides us.

I am deeply grateful to my supervisor **Professor Abou El Maged A. Mohamed**, Professor of Applied Mathematics, Faculty of Education, Ain Shams University, for suggesting the problem involved in this work and for his guidance, valuable suggestions and discussions throughout his supervision of this work.

I am deeply grateful to my Co. supervisor **Dr. Mohamed F. Elsayed**, Lecturer of Applied Mathematics, Faculty of Education, Ain Shams University, for his kind help, guidance and facilities offered throughout this investigation.

I would like to acknowledge my deepest gratitude to **Dr. Yassmen D. Mahmoud**, Lecturer of Applied Mathematics, Faculty of Science, Suez Canal University, for her cooperation, helpfulness and kindness. I am also indebted to **Professor Elsayed M. ElGazzy**, Professor of Pure Mathematics, Faculty of Education, Ain Shams University for his encouragement during this research. Also, I would like to acknowledge my deepest gratitude to **Dr. Elsayed M. Elsayed**, Lecturer of Pure Mathematics, Faculty of Education, Ain Shams University for his encouragement and cooperation.

Finally, thanks are due to the chairman and the staff of the Department of Mathematics, Faculty of Education, Ain Shams University, for the facilities they kindly offered through this investigation specially **Mahmoud M. Ramadan**, Assistant Lecturer and **Mr. Mostafa Elshahed**.



Contents

Summary	-----	(i)
---------	-------	-----

Chapter (1)

Introduction

1.1 General Introduction

1.1.1. Fluid Mechanics	-----	2
1.1. 2. Classification of Fluids		
1.1.2.1. Newtonian Fluids	-----	2
1.1.2.2. Non-Newtonian Fluids	-----	3
1.1.3. Motion of Fluid Particles	-----	3
1.1.4. Some Types of Flow	-----	4

1.2 Specific Introduction

1.2.1. Electrohydrodynamic Stability	-----	5
1.2.2. Kelvin-Helmholtz Instability	-----	7
1.2.3. Heat and Mass Transfer	-----	10
1.2.4. Governing Equations	-----	12

Chapter (2)

Electrohydrodynamic Kelvin-Helmholtz Instability for Conducting Fluids. The Effect of Heat and Mass Transfer under a Tangential Electric Field.

2.1. Introduction	-----	20
2.2. Description of the Problem	-----	21

2.3. Equations of Motion	21
2.4. The Perturbation Equations	26
2.5. The Boundary Conditions	
2.5.1. <i>The conservation of mass across the interface</i>	28
2.5.2. <i>The tangential component of the electric field</i>	28
2.5.3. <i>The conservation of charge</i>	29
2.5.4. <i>The interfacial condition for energy transfer</i>	29
2.5.5. <i>The conservation of momentum balance</i>	31
2.6. Dispersion Relation	33
2.7. Conditions of the Stability	40
2.8. Discussion of the Stability	41
2.9. Conclusion	43

Chapter (3)

Electrohydrodynamic Kelvin-Helmholtz Instability for Conducting Fluids. The Effect of Heat and Mass Transfer under a Normal Electric Field.

3.1. Introduction	59
3.2. Description of the Problem	60
3.3. The Perturbation Equations	62
3.4. The Boundary Conditions	
3.4.1. <i>The conservation of mass across the interface</i>	64
3.4.2. <i>The tangential component of the electric field</i>	64
3.4.3. <i>The conservation of charge</i>	65
3.4.4. <i>The interfacial condition for energy transfer</i>	65

3.4.5. <i>The conservation of momentum balance</i>	66
3.5. Dispersion Relation	66
3.6. Conditions of the Stability	73
3.7. Discussion of the Stability	75
3.8. Conclusion	77
References	92
<u>Appendices</u>	
Appendix (1)	97
Appendix (2)	100
Arabic Summary	

