

سامية محمد مصطفى



شبكة المعلومات الجامعية

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



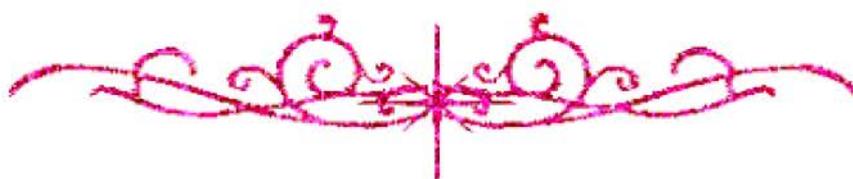
سامية محمد مصطفى



شبكة المعلومات الجامعية



شبكة المعلومات الجامعية التوثيق الالكتروني والميكروفيلم



سامية محمد مصطفى



شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات



يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار



سامية محمد مصطفى



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بعض الوثائق الأصلية تالفة



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شبكة المعلومات الجامعية



بالرسالة صفحات

لم ترد بالأصل



Menoufia University
Faculty of Science
Mathematics Department



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19997

THE SOLUTIONS OF NON-LINEAR DIFFERENTIAL EQUATIONS

A Thesis

Submitted to Department of Mathematics, Faculty of Science,
Menoufia University in Partial Fulfillment of the Requirement for the
Master Degree of Science
(Pure Mathematics)

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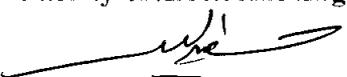

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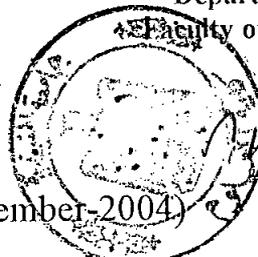
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(November 2004)







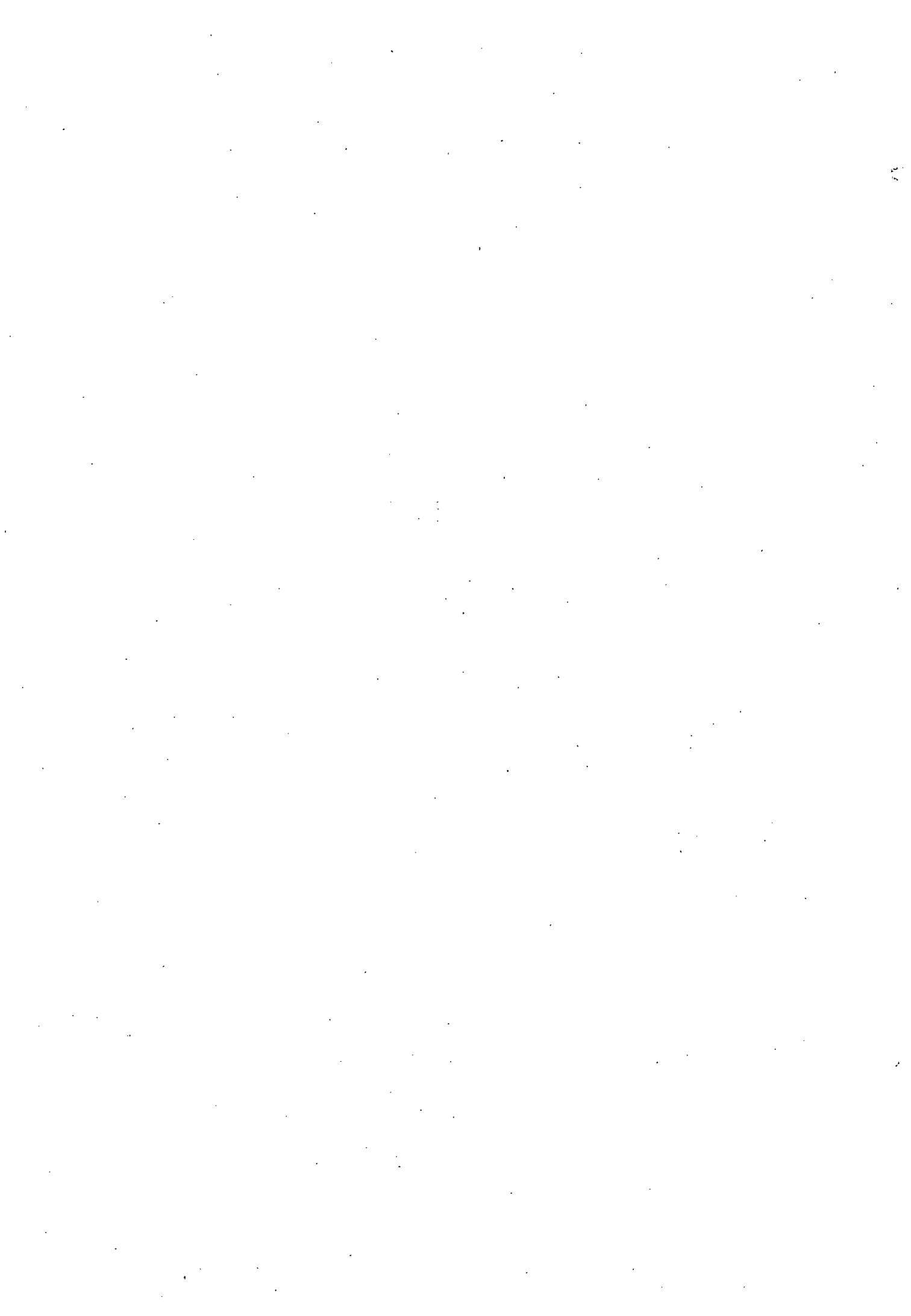


بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

وَمَا أَوْفَيْتُمْ

مِنَ الظُّلْمِ

الْأَقْبِلِ



Summary

The main object of this thesis is to study the non-linear differential equations which describe the vibrational motion of systems represent many applications in the field of engineering, physics, mechanics and electronics. The mathematical model which is studied in this thesis is a second order non-linear differential equation which describes the vibration of a buckled beam under either external or both external and parametric excitation forces. We obtained the solution of the mathematical system applying both the analytical and numerical methods

We divide this investigation in the thesis into four chapters:

Chapter One

This chapter deals with the objective of this work and the previous work.

Chapter Two

Chapter two includes the solution of the non-linear differential equation describing the vibration of a buckled beam subjected to harmonic excitation force only. Multiple time scale is applied to obtain both the solution up to and including the second order approximation and the different resonance cases. We also studied the stability of the system using both frequency response equation and the phase-plane for the worst resonance cases which were confirmed applying numerical methods.

Chapter Three

Chapter three deals with both analytical and numerical results of the buckled beam subjected to both parametric and external excitation forces. Multiple time scale is applied to obtain the solution up to and including the second order approximation and the different resonance cases. We also studied the stability of the system using both frequency response equation and the phase-plane for the worst resonance cases which were confirmed applying numerical methods.

Chapter Four

This chapter demonstrates the main obtained conclusions of the work, due to both analytical and numerical investigations. A comparison is made between the two different considered systems. Two papers of the reported work have been published.

References:

It contains a list of the used references in the thesis.

Appendices:

It contains two appendices regarding the constants used in the derived solutions of both considered systems.

ACKNOWLEDGEMENTS

Before all, I do indeed thank Allah Almighty who guided and aided me to bring forth to light this thesis.

I wish to express my sincere gratitude to Prof. Dr Ramadan Abdel-Ati, Head Department of Mathematics, Faculty of Science Shibin EL-kom, and to Associate Prof. Dr. M. H. Eissa Department of Physics and Engineering Mathematics, Faculty of Electronic Engineering, for his excellent guidance, helpful discussions and continuous encouragements during the developments of this work.

I would like to express my deep appreciation to my supervisors Prof. Dr. S. A. EL-Serafi, Professor of Mathematics, and Vice Dean for Community Services and Environmental Affairs, Faculty of Electronic Engineering, Prof. Dr. M. M. EL-Sheikh Professor of Mathematics, Faculty of Science Shibin EL-kom, and Dr. M. M. Kamel Associate Professor of Mathematics, Faculty of Electronic Engineering, for their excellent guidance, helpful discussions and continuous encouragements during the developments of this work.

I wish to extend my thanks to all staff members of the Department of Physics and Engineering Mathematics, Faculty of Electronic Engineering, Menoufia University.

My grateful thanks to my family and friends, for their encouragement and understanding, during the preparation of this thesis.

Ashraf El-Mandouh Abo-helal

ABSTRACT

Vibrations and dynamic chaos are undesired phenomenon in structures. They cause disturbance, discomfort, damage and destruction of the system or the structure. Money, time and effort are spent to get rid of both vibrations, noise and chaos or to minimize them. Also, resonance of oscillating systems may lead to their damage or destruction. For these reasons it is very important to study the behavior of the vibrating system under different resonance conditions.

The main object of this thesis is to study vibration behavior of the dynamical systems. Such systems represent many applications in the field of physics, mechanics, electronics and engineering. One of the important systems expressed here is one degree of freedom system, which is governed by a second order non-linear differential equation. The nonlinearity of this system depends on the spring stiffness or the damping factors, or the excitation force.

In this work one degree of freedom system representing the vibration of a buckled beam under either external or both external and parametric excitation force have been considered. An extensively studies about the buckled beam have been demonstrated in chapter one.

In chapter two the non-linear differential equation that describe the vibration of buckled beam subjected to harmonic excitation force has been considered and solved analytically and numerically. The steady state response and its stability near the primary resonance case is investigated and studied. Effects of the different parameters on the system behavior and jump phenomenon on the frequency response curves are also investigated and studied. Some of the results of this chapter are published [44].

Chapter three deals with both analytical and numerical results of the buckled beam subjected to both parametric and external excitation forces. The stability of the steady state solution near sub-harmonic resonance case and the numerical solution is obtained and studied. The effects of different parameters on the steady state response of oscillation are investigated and studied also. Some of the results of this chapter are published [45].

The main conclusions of the work, followed by some recommendations regarding the design of such system have been reported in chapter four.

NOMENCLATURE

A, B	Complex functions in T_1 .
a, b	Steady state amplitudes of the buckled beam
D_0, D_1 and D_2	Differential operators; $D_n = \frac{\partial}{\partial T_n}$, ($n = 0, 1, 2$).
T_0 and T_1	Fast and slow time scales respectively; ($T_n = \varepsilon^n t$).
t	Time.
$F(t)$ and $G(t)$	Excitation force.
f and f_1	Excitation force amplitudes.
ω_0 and ω	Natural frequencies
Ω and Ω_1	Excitation force frequencies
$C_n, E_n, g_i, M_n, N_n, L_n, R_n, S_n, V_n,$ and Z_n	Real coefficients.
μ, μ_1	Damping coefficients
\dot{U} and \ddot{U}	Longitudinal response derivatives with respect to t
α and β	Non-linear parameters.
δ and δ_1	Phases of the motion.
ε	Small perturbation parameter.
θ and φ	Real functions of T_1 and phases of the motions.
λ	Eigenvalue.
σ and ρ	Detuning parameter.