DIFFERENTIAL GEOMETRIC GUIDANCE AND CONTROL SYSTEMS OF TACTICAL HOMING MISSILES AND AIR DEFENSE SYSTEMS

By

Yunes Sharaf N. Al-Qadasi

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of

MASTER OF SCIENCE
in
Aerospace Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Under the Supervision of

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Title of Thesis:

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Key Words:

Homing Guidance; Differential Geometry; Air Defense Systems (ADS); Target Interception; Line-of-Sight (LOS).

Summary:

The concepts of differential geometric control theory provide useful tools of modelling, analysis and design for the nonlinear guidance and control systems.

In order to obtain better control, precise accuracy and flexibility for the intercept and engagement trajectories for homing missiles guidance and control systems geometrical approach and Lyapunove theory are used. The differential geometric approach is more generalized guidance algorithm, which deals directly with the system's nonlinearities which improves the algorithm accuracy, at the same time, differential geometry techniques consider the curved and straight-line trajectories for both the targets and missiles. Furthermore, the concepts of differential geometry assist to develop an optimization algorithm for the guidance and control of homing missiles and Air defense systems.

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I also dedicate this thesis to my beloved parents, Sharaf and Jamila, and special thanks to my wife “Jory” for their endless support, patient and understanding, they really were essential assist to achieve this work. Also for my angel baby “Rahof” the additament happiness to my life.

Dedication

To

My Parents

My Wife

and

My Daughter (Rahof)

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