بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

MOTION PLANNING, GUIDANCE AND CONTROL OF AUTONOMOUS SWARM FLYING-ROBOTS

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
DOCTOR OF PHILOSOPHY
in
Aerospace Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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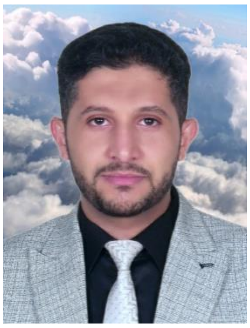

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Title of Thesis:

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Key Words:

Swarm UAVs; Multi-Robot Path Planning; Multi-Robot Task Allocation; Optimal Trajectory Generation; UAV Swarm Formation Control

Summary:

Small Unmanned Flying Vehicles (UFV) such as multicopters have gained a considerable popularity over the last years. This noticeable interest has arisen due to their versatility, agility, maneuverability, and large range of applications. However, some complicated tasks and applications required a swarm formation consists of multiple flying robots working in a collaborative and coordinated manner to effectively accomplish the intended missions. This dissertation proposes a set of algorithms to deal with motion planning, trajectory generation and control of basic behaviors and typical missions in swarm robotics such as: Synchronous Allocation and Planning of Trajectories (SAPT) both in obstacle-free and obstacle-cluttered environments, Multi-Robots Guidance Problems (MRGP), Pattern Formation and Collective Movement Control (PFCMC), and Guided Swarm to Intercept Moving Targets (GSIMT). All aforementioned tasks are modeled and implemented in MATLAB with three-dimension animation and simulation to demonstrate the convergence and features of the proposed algorithms. These basic missions will be applied to different swarm applications.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

Name: **Yunes Sharaf N. Al-Qadasi** Date: …/ ... /2021

Signature:

Dedication

*To my **Father** & **Mother***

*To my **Wife** and our kids, **Rahaf** & **Rayan***

*To all my **Family***

Acknowledgments

In the name of Allah, the most beneficent, the most merciful.
All the praises and thanks to Allah for the strength and his blessing in completing this dissertation

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