

SIMPLIFIED ALGORITHM FOR A CONSTANT SPEED MISSILE

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*To my honourable lecturer and supervisor, Dr Shahrum Shah Bin Abdullah,
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ABSTRACT

Disputes and unstable status of today's world must be tackled wisely and as those irresponsible parties may decide to use missile as their option weapon. This matter should be in top priority as the number of the terrorist attacks keep increasing from time to time and the technology knowledge of terrorist should not be look down upon. A suitable missile defense system for the Malaysian Army is very vital for the success of a mission. In this project, the development process of this system is customized to suit the Malaysian Army's needs and its framework is suggested to be used for all the development projects that will be involving the military in Malaysia. The missile technology is still young in this region and it is a very vital technology for any countries to develop themselves for their own defense purposes. In this century, the sources of threat from other countries and terrorist groups towards our country have increased tremendously. The objective of the project is to realized the movement of a constant speed missile in a 2D simulation form. The simulation was performed using MATLAB 6.5 software with certain assumption and constraints such as the location of the enemy/target is stationary, no environmental factor such as gravitational, aerodynamics or propulsion of the missile to be considered and the missile itself has a constant speed and have a limited turning point. This thesis hopefully will initiate a basic concept in guiding a missile toward its target. The project was developed generally and it can be extends in terms of problem and application other investigation for future works.

ABSTRAK

Pergolakan di sekitar dunia pada masa kini mesti diberi perhatian yang sewajarnya dalam menghadapi sebarang kemungkinan serangan dan ancaman peluru berpandu. Perkara ini dipandang serius dengan peningkatan jumlah pergerakan yang telah dilakukan oleh pihak penganas dan tahap teknologi yang diperolehi oleh mereka. Satu sistem pertahanan peluru berpandu untuk Tentera Darat Malaysia (TDM) adalah amat penting bagi membolehkan satu misi mencapai objektifnya. Kajian projek ini telah membangunkan satu sistem pertahanan peluru berpandu yang sesuai untuk digunakan di dalam Malaysia. Sistem pertahanan peluru berpandu ini dibangunkan dengan menggunakan kesemua proses pembangunan produk yang dicadangkan untuk kegunaan TDM. Teknologi peluru berpandu ini masih boleh diterokai dengan lebih mendalam kerana ianya merupakan satu proses pertahanan yang kritikal dan penting di dalam pertahanan Malaysia. Dalam abad ini, punca ancaman daripada negara lain dan juga kumpulan penganas terhadap negara kita telah meningkat secara mendadak. Salah satu daripada perkara yang telah meningkat kepentingannya secara global adalah sistem pertahanan peluru berpandu. Objektif projek ini adalah untuk merealisasikan pergerakan sebuah peluru berpandu dengan pecutan tetap dalam bentuk simulasi 2D. Simulasi ini dilakukan dengan menggunakan perisian MATLAB 6.5 dengan beberapa anggapan dan kekangan seperti lokasi musuh/sasaran adalah tetap, tidak mengambilkira faktor semulajadi seperti graviti, aerodinamik atau daya tujahan bahan api peluru berpandu serta ianya mempunyai pecutan yang tetap dan kebolehan membelok yang terhad. Tesis ini diharapkan dapat memulakan konsep asas dalam pengenalan peluru berpandu ke sasaran yang dikehendaki. Projek ini dibangunkan secara am dan ianya boleh dikembangkan dalam bentuk permasalahan dan aplikasi pada masa akan datang.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	DECLARATION	ii
	DEDICATION	iv
	ACKNOWLEDGEMENT	v
	ABSTRACT	vi
	ABSTRAK	vii
	TABLE OF CONTENT	viii
	LIST OF TABLES	xi
	LIST OF FIGURES	xii
1	INTRODUCTION	1
	1.1 Introduction	1
	1.2 Algorithm Definition	1
	1.3 Electronic Warfare Definition	2
	1.3.1 Electronic Support (ES)	2
	1.3.2 Electronic Attack (EA)	2
	1.3.3 Electronic Protect (EP)	3
	1.4 Objective	3
	1.5 Scope Of Work	3
	1.6 Outline Of The Thesis	4

2	LITERATURE REVIEW	6
2.1	Introduction To Guided Weapon	6
2.2	Overview Of Existing Path Planning Technique	7
2.2.1	Kinematics/ Relative Geometry	7
2.3	Close Loop System	12
2.4	Homing Guidance	12
2.5	Basic Trajectory Analysis	13
2.5.1	Kinematics	14
2.5.2	Turn Rate And Lateral Acceleration	14
2.6	The Concept	15
3	METHODOLOGY	18
3.1	Introduction	18
3.2	Problem Depiction	18
3.3	The Execution of Geometrical Analysis	21
3.4	The Execution of MATLAB Simulation	24
3.5	Conclusion	26
4	RESULTS	27
4.1	Introduction	27
4.2	Result Of The Geometrical Analysis	27
4.3	Result Of The MATLAB Simulation	30
4.4	Comparison Of Geometrical Analysis And MATLAB Simulation	33
4.5	Result by Varying The Parameters in MATLAB Simulation	33
4.5.1	Change The Initial Direction To 0 Degree	34
4.5.2	Change The Initial Direction To 180 Degree	36
4.5.3	Change The Initial Direction To 270 Degree	38

4.5.4	Change The Initial Direction To 45 Degree	40
4.5.5	Change The Initial Position (-2 -2)	42
4.5.6	Change The Initial Distance 10 cm	44
4.5.7	Change The Initial Distance 5 cm	46
4.5.8	Change The Steering Constant -15 Degree	48
4.5.9	Change The Steering Constant -30 Degree	50
4.5.10	Change The Steering Constant 20 Degree	52
4.5.11	Change The Steering Constant 20 Degree And The Target Angle To 140 Degree	54
4.5.12	Change The Target Angle 140 Degree	56
4.5.13	Change The Velocity Constant 0.5 cm/s	58
4.5.14	Change The Velocity Constant 4 cm/s	60
5	CONCLUSION	62
5.1	Introduction	62
5.2	Conclusion	62
5.3	Future Development	63
	REFERENCES	64

LIST OF TABLES

TABLE NO	TITLE	PAGES
3.1	Determined parameters for initial work	20
3.2	Definition of parameters used in MATLAB	25
4.1	The result of calculation with mathematical equation	28
4.2	MATLAB simulation result	33
4.3	Result comparison using geometrical analysis and MATLAB simulation	34
4.4	The changes in parameters when initial direction= 0^0	36
4.5	The changes in parameters when initial direction= 180^0	38
4.6	The changes in parameters when initial direction= 270^0	40
4.7	The changes in parameters when initial direction= 45^0	42
4.8	The changes in parameters when initial position (-2,-2)	44
4.9	The changes in parameters when target distances 10 cm	46
4.10	The changes in parameters when target distances 5 cm	48
4.11	The changes in parameters when steer ability -15 degree	50
4.12	The changes in parameters when steer ability -30 degree	52
4.13	The changes in parameters when steer ability 20 degree	54
4.14	The changes in parameters when steer ability 20 degree and target angle 140 degree	56
4.15	The changes in parameters when target angle 140 degree	58
4.16	The changes in parameters when velocity constant 0.5 cm/s	60
4.17	The changes in parameters when velocity constant 4 cm/s	62

LIST OF FIGURES

FIGURE NO	TITLE	PAGES
1.1	Flowchart represent the scope of work	4
2.1	List of the wavelength main uses in guided weapon	7
2.2	Pursuer/Target scenario contains in the change in time of the vector from the pursuer to the target	8
2.3	Kinematics equations	10
2.4	Guidance loop	11
2.5	The close loop system	12
2.6	Basic trajectory analysis	13
2.7	Basic idea in forming the algorithm	16
2.8	Enhancement of parameter in Figure 2.7	16
3.1	Illustration of the original problem	19
3.2	The visual depiction of the original problem	19
3.3	The visual depiction in plotting execution	21
3.4	The visual depiction in MATLAB simulation execution	24
3.5	Flowchart of the MATLAB program	26
4.1	MATLAB program used in order to guide the missile to its target	32
4.2	Missile movement using MATLAB simulation	32
4.3	Missile simulation when initial direction is change to 0 degree	35
4.4	Missile simulation when initial direction is change to 180 degree	37
4.5	Missile simulation when initial direction is change to 270 degree	39

4.6	Missile simulation when initial direction is change to 45 degree	41
4.7	Missile simulation when changes initial position (-2,-2)	43
4.8	Missile simulation when target distance 10 cm	45
4.9	Missile simulation when target distance 5 cm	47
4.10	Missile simulation when changes steer ability -15 degree	49
4.11	Missile simulation when changes steer ability -30 degree	51
4.12	Missile simulation when changes steer ability 20 degree	53
4.13	Missile simulation when change steer ability 20 degree and target angle 140 degree	55
4.14	Missile simulation when target angle 140 degree	57
4.15	Missile simulation when velocity constant 0.5 cm/s	59
4.16	Missile simulation when velocity constant 4 cm/s	61

CHAPTER 1

INTRODUCTION

1.1 Introduction

This thesis was written for the purpose in presenting an algorithm that can define a movement of a constant speed missile until it reach its desired target or location. This will involve some of the navigation, guidance and control processing topic which are the guide line in developing the algorithm. In electronic warfare (EW) system, the determination a location of a target location is one of the fundamental function.

1.2 Algorithm Definition

Algorithm is a finite set of well define instruction in accomplishing a task with the given initial state until it reach it end state. There are various way in classifying an algorithm. In terms of implementation, an algorithm can be define in mean of recursion/iteration, logical, serial/parallel, deterministic/non deterministic, and exact/approximate. Sometimes it can also be classified by design paradigm such as devide and conquer, dynamic programming, greedy method, linear programming, reduction, search and enumeration and probabilistic and heuristic paradigm [1].

1.3 Electronic Warfare Definition

EW is military action to exploit the electromagnetic spectrum which encompasses the interception, identification and location of electromagnetic emissions. The employment of electromagnetic energy to reduce or prevent hostile use of the electromagnetic spectrum and actions to ensure its effective use by friendly forces [2]. Electronic warfare has three main components: electronic support, electronic attack, and electronic protection.

1.3.1 Electronic Support (ES)

Electronic support (ES) is the passive use of the electromagnetic spectrum to gain intelligence about other parties on the battlefield in order to find, identify, locate and intercept potential threats or targets. This intelligence, known as ELINT, might be used directly by fire-control systems for artillery or air strike orders, for mobilization of friendly forces to a specific location or objective on the battlefield, or as the basis of electronic attack or electronic protection actions. Because ES is conducted passively, it can be performed without the enemy ever knowing it. Its counterpart, SIGINT, is continuously performed by most of the world's countries in order to gain intelligence derived from other parties' electronic equipment and tactics. An older term for ES is electronic support measures (ESM)[3].

1.3.2 Electronic attack (EA)

Electronic attack (EA) is the active or passive use of the electromagnetic spectrum to deny its use by an adversary. Active EA includes such activities as jamming, deception, active cancellation, and EMP use. Passive EA includes such activities as the use of chaff, towed decoys, balloons, radar reflectors, winged decoys, and stealth. EA operations can be detected by an adversary due to their active transmissions. Many modern EA techniques are considered to be highly classified. An older term for EA is electronic countermeasures (ECM)[3].

1.3.3 Electronic Protection (EP)

Active EP includes such activities as technical modifications to radio equipment (such as frequency-hopping spread spectrum). Passive EP includes such activities as the education of operators (enforcing strict discipline) and modified battlefield tactics or operations. Older terms for EP include electronic protective measures (EPM) and electronic counter countermeasures (ECCM)[3].

1.4 Objective

The main objective of this project is to realize the movement of a missile towards the desired destination in a simulation form. In order to accomplish the project, the following sub-objectives are necessary to be achieved before hand.

- 1.4.1 To implement and possibly improve the existing mathematical model of path planning for constant speed missile.
- 1.4.2 To develop simulations for the movement of a constant speed object representing a constant speed missile
- 1.4.3 To implement existing guidance algorithm that allowing the constant speed missile reaching the desired destination from its initial position.

1.5 Scope of Work

The scope of work is to clearly define the specific field of the research and ensure that the entire content of this thesis is confined to the scope. It is begins with the implementation or possibly an improved implementation of existing mathematical model on a missile for the following specifications such as it has constant speed at all times with velocity of $v(t)$ and limited swerving ability of $\alpha(t)$.

The next step is to model a simulation to represent the missile as per the specifications. Then the missile is visualized in a simulation to move from its initial position to the desired destination. Finally, the validation of the approach effectiveness is carried out in between the targeted and simulation destination. The scope of work can be described in terms of flowchart as per the following **Figure 1.1**.

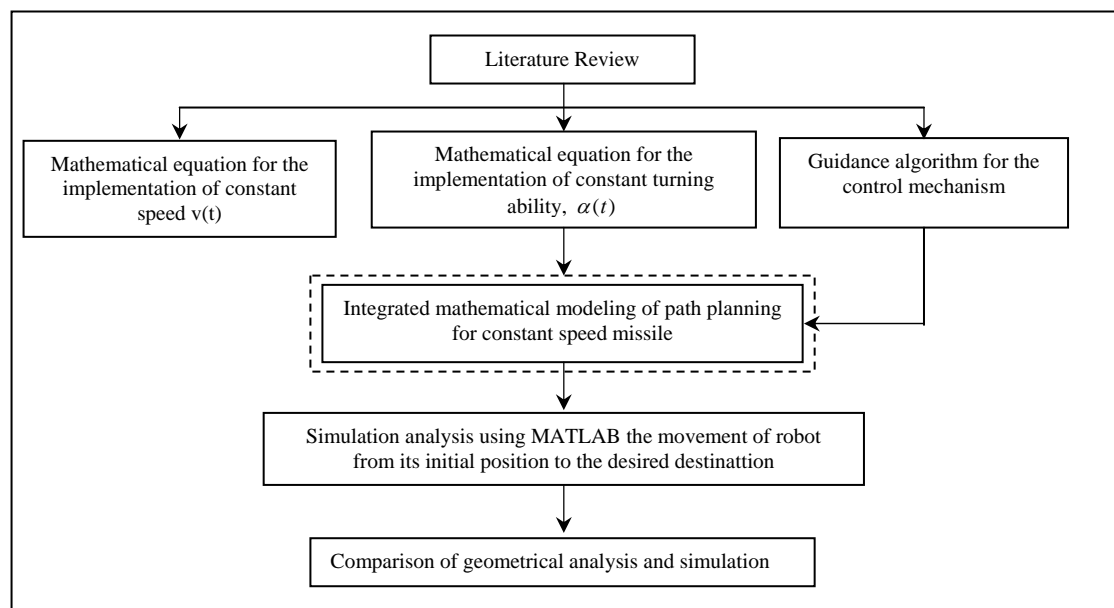


Figure 1.1 : Flowchart represent the scope of work

1.6 Outline Of The Thesis

Chapter 1 in this thesis basically an introduction of all the topics and discussion which involve in developing the algorithm. It seem to be the overview of all the subject in the thesis.

Chapter 2 is the literature review which introduces the overview of the existing algorithm and missile research. The explanation begins with the related existing work which is found to be related to this project. This chapter is then described the existing missile system implementation and current interest in the missile research.

Chapter 3 provides the method that is used of this project. It covers the technical explanation of this project and the implemented technique of mathematical equations and guidance algorithm for both plotting and simulation.

Chapter 4 deals with the results of the geometrical analysis and MATLAB's simulation. The multi-conditions of the execution for MATLAB's simulation will also be presented in this topic.

Chapter 5 presents the conclusions of the project as well as some constructive suggestions for further development and the contribution of this project. As for future development, some suggestions are highlighted with the basis of the limitation of the effectiveness mathematical equation and simulation analysis executed in this project. The aim of the suggestions is no other than the improvement of the study.