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Parameters Simulation of Missile Track Trace with Linear、Quadratic & Exponential Equation I

Xu Run

Gyeongsang National University, Metallurgical Engineering Department, Gyeongnam, Chinju 52828, Korea

Abstract: *- the missile simulation as attacking weapon in fight has been studied recently in papers. In this paper it is discussed that the difference length L and height H and parameter a&b and n&K are. The linear, quadratic and exponential function with independent variable is discussed and find the accuracy is the finest at parameter K of this equation while it is the lowest at simple equation and parameter n of this equation. The length of 1Km and height of 2Km and 1.5Km is the predicted best positions in simple linear equation. The length of 1.5Km and height of 2Km and then length of 1Km and height of 1.5Km is the best two positions in exponential equation.*

Keywords: *- missile track trace，simulation, simple equation; quadratic and exponential equation, parameter a &b; n &K*

1 Introduction

The missile has become a significant automatic track weapon in currency military as an attacking tool. It is strong missile who owns it who could won the war is clear more and more. So it has to be a significant issue to research missile that can carry nuclear missile to menace strategy role among countries. At first it is searched that missile track trace is important too since the inertia force and gravity weight exists in. [1,2] In this paper the missile track trace has been searched to look for parameters on simple and quadratic equation for benefiting parameter a & b with height & length. Through calculating the equations are erected for them. It has been hopeful that the results will benefit for accurate control missile by plane. Because the final stage is determined in missile attacking target usually by plane the attacking trace in final is proposed to significant position to think over and calculate carefully. In order to attack accurately the missile track trace equation need to be established and check carefully as soon as possible in modern war. We can discuss the accuracy of missile according to parameter n &K in detail to simulate the practical work. Due to exponent function facility we can utilize it to solve directional track trace of missile. Through comparing with them we try to look for relation between them. In general simple trace with linear trace is easy to obtain aim scope but its precision is low. Meantime the exponential trace is hard to control but it can raise the track precision. Once we put condition such as parameters of n and K track is controlled and proceeded precise track trace of aim. In air to surface or ship missile the position to attack aim is very important so that it is simulated for us to judge the precise attack position in this paper to find easy control method to control missile track trace is our destination and aim. That the missile track trace is longed into more than 0.5Km is the main topic in this paper. It is continuous to find some trends in trace in this paper that is way to conquer it based on the last paper which discussed several hundred meters' track trace. [1]

2 Simulation and discussion

2. 1 Simple equation

It is supposed that [1]

$$Y = aX + b \quad (1)$$

Let O(X_0,Y_0); point C(X_1,Y_1), here

X_0=0,Y_0=0; X_1=L,Y_1=H.

Let these points replace (1) and obtain

$$a = \frac{H - b}{L^2} \quad (2), \quad b = 0 \quad (3)$$

H is the missile height; L is the horizon distance to objection. A and b is coefficient.

2.2 Exponential equation

It is supposed that

$$Y = KX^n + C \quad (4)$$

Let O(X_0,Y_0); point 1(X_1,Y_1); point2(X_2,Y_2), here

X_0=0,Y_0=0; X_1=L,Y_1=H1; X_2=L,Y_2=H2

Let these points replace (7) and obtain

$$n = \frac{LN(H_1 / H_2)}{LN(L_1 / L_2)} \quad (5)$$

$$LNK = LNH_1 - \frac{LN(H_1 / H_2)}{LN(L_1 / L_2)} LNL_1 \quad (6)$$

2. 3 Quadratic equation

It is supposed that

$$Y = aX^2 + bX + c \quad (7)$$

Let O(X_0,Y_0); point 1(X_1,Y_1); point2(X_2,Y_2), here

X_0=0,Y_0=0; X_1=L,Y_1=H1; X_2=L,Y_2=H2

let these points replace (4) and obtain

$$b = \frac{L_2^{\,2} H_1 - L_1^{\,2} H_2}{L_1 L_2^{\,2} - L_2 L_1^{\,2}} \quad (8)$$

$$a = \frac{L_1^{\,2} H_2 (1 - L_2)}{(L_1 L_2^{\,2} - L_2 L_1^{\,2}) L_2^{\,2}} + \frac{L_1 H_2 - H_1}{L_1 L_2^{\,2} - L_2 L_1^{\,2}} \quad (9)$$

Table1 n &K and L1 &L2 and H1 &H2 conditions in exponential equation.

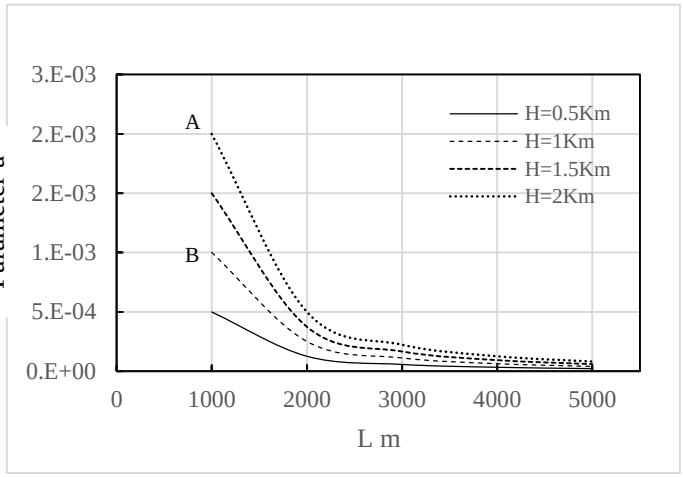
No. / L& H	1	Adopted parameters
L1,m	1~5Km	n, x
L1,m	0.5~2.5Km	K, x
H2,m	1.5Km	n,K
H1,m	2Km	n, K
L2,m	0.5~2.5Km	K, variable
L2,m	2~6Km	n, variable

Table2 a & b and L1 &L2 and H1 &H2 conditions in quadratic equation.

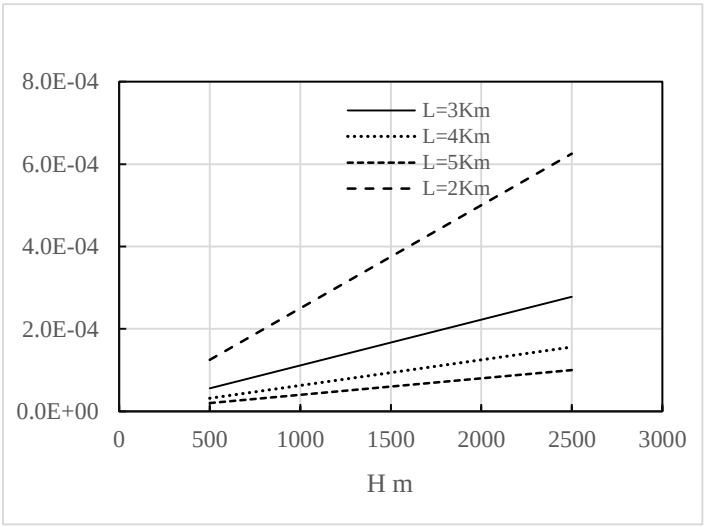
No. / L& H	1	Adopted parameters
L2,m	1~5Km	b, x
H2,m	0.5~2.5Km	a, x
L1,m	5Km	a
H2,m	5Km	b
H1,m	2Km	b
L2,m	2~5Km	a&b, variable

Table 1 represents the adopted parameters' conditions of height H1, 2 and length L1, 2 exponential equation for inference. It is used that different method in parameters n and K in exponential equation of missile track trace. Table 2 represents another conditions in quadratic equation. Here x is independent variable. Variable is type x variable.

As seen in Figure 1（a）the A, B and C is concluded as below. The longitudinal 1000m and height 2000m has the biggest a at the A in simple equation, expresses the best distance for missile attack. And then height 1500m at the B has second biggest K expresses the second best distance. In general the height 2000m is the biggest n, expresses the best height for attack and them 1500m. 1000m, at last 500m is the height which is better position in turn. It is said that the bigger n has better control function. So that the best point is a point with length of 1000m and height of 2000m. The second point is B with length of 1000m and height of 1500m and then the rest turn is neglected which coordinate is (1000m,1000m) & (1000m,500m). Length is basal factor to be considered according to parameter behavior with the simple equation. So it must be put basal position in this equation. And then the height is considered as second factor discussed as above



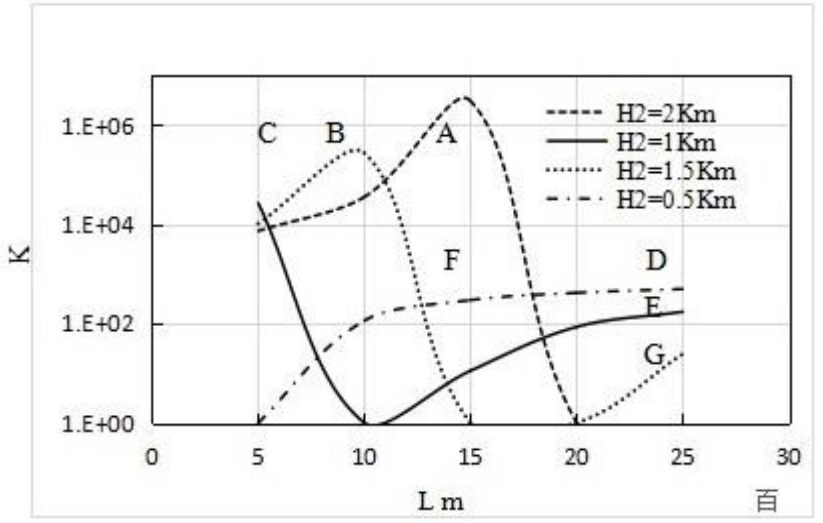
(a) L and a



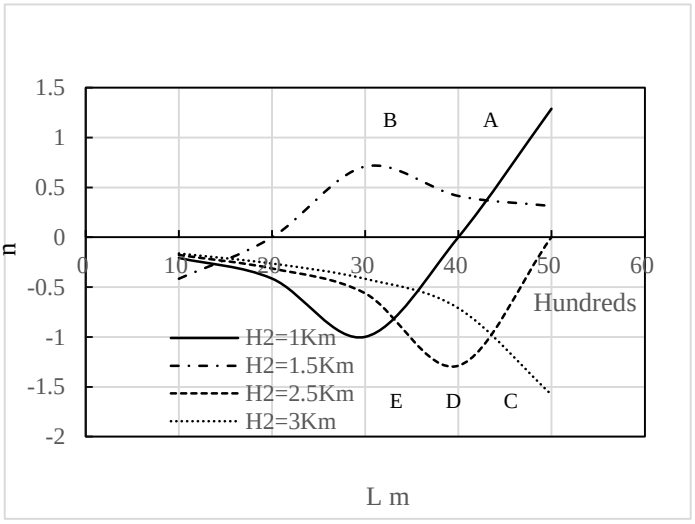
(b) H and a

Figure 1 parameters of an in simple equation at missile attack

As seen in Figure 2（b）A, B and C point is explained as below. The longitudinal 1.5Km at the A has the biggest K in exponential equation, expresses the best distance for missile attack. And then 1Km has second biggest K at the B expresses the second best distance. The third one is 0.5Km at the C. In general the height 2Km is the biggest K, expresses the best height for attack. And then 1.5Km、1Km and at last 500m is the height which is best position in turn. So that the best point is a point with length of 1.5Km and height of 2Km. The second point is B with length of 1Km and height of 1.5Km and then third point is C which length is 0.5Km and height is 1Km. It is considered that these two factors could be combined together to define the best position for missiles to proceed attack. In detail only the combined data should be observed and deduced can we judge the best position for missiles to take an aggression. According to K>n principle we could judge the position to attack aims. It is needed to have experiment to judge it. As we knew there are big change in K according to simulation. It should be judged that easy control method to adopt in terms of experiment. Not to know many but to no one can we control the parameters for best attack position because a pilot doesn't know more positions to confuse his judge in exponential equation of track trace. Certainly the detailed judge need to be according to dynamics and automatic control of plane speed, missile gravity and promoting force. At the other positions D, E, F &G it is (0.5KmL, 2.5KmH), (1KmL, 2.5KmH) and (1KmL, 0.5mH) which is rest best position turn in Figure 2(a). As for n in Figure 2(b) points A &B is 5Km length and 1Km height for former and 3Km length and 1.5Km height for later. The former is best position and then the later. C, D & E is 5Km L &3Km H, 4Km L &2.5Km H and 3Km L &1Km H, this is the turn of the rests. In the war of Malvinas the Argentina pilot drove a fighter shot a missile to hit the Britain warship. The length is about several Km and it is between A and C in Figure 2(b). It is a mediate position to wield good effect. The n becomes mediate and to control accurately. If he raised the plane to more than 2Km the more endeavor or better missile is needed to be accurately hit the Britain warship due to big n.



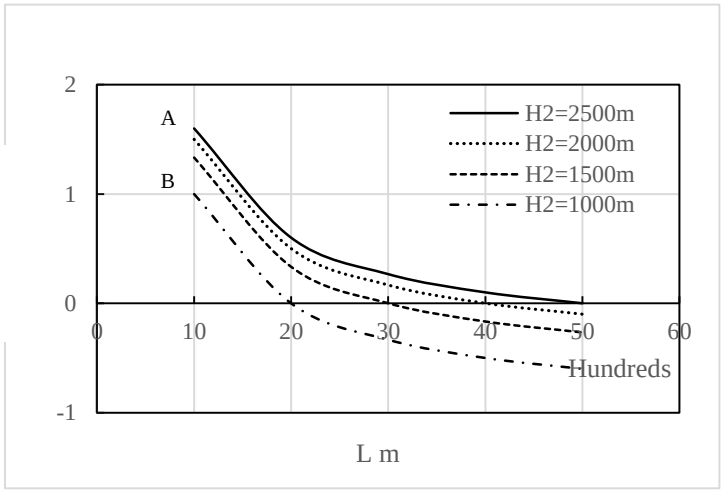
(a) n and L under L condition in exponential equation



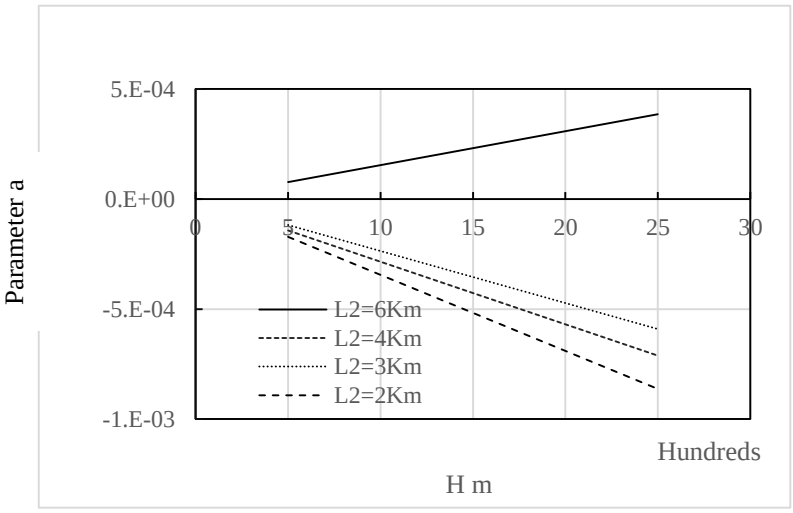
(b) K and H2 under H2 condition

Figure 2 parameter K in exponential equation at missile attack.

From Figure 3(a,b) the H is big the a is same too meanwhile the a is small if H is big. From Figure3 it is shown that with big L the b is small and at height 2Km the b is the biggest at 1Km which is summit then it slowly become small. Meanwhile, with big L the b is small which is down slowly. The track parameter b is big, expresses the good scope be controlled by parameter. If b has wave in a certain field the control will be easy to attain. b will be directly controlled by L and control H. If b is big from 0.5 to 2.5 the H would have been big too to attain. In general the parameter b will be difficultly controlled with a low value. From Figure 3(a) it is observed that with increasing height the b will be high so that the mediate height is more available when b is mediate in linear track. At the point A the coordinate (2500mH, 1000mL) is the best position for missile track. But from Figure 3(b) it is known that the one below 2500m length is high so that the length must be more than 1500m at least the missile can be controlled to attack target accurately and firmly by plane. In 1000m of length the preparation is available enough so it is in charge of the accuracy firmly. At the point A the coordinate (1000mL, 2500mH) is the best position for missile track. And then at the B it is (1000mL, 2000mH) which is second best position. In general the height of 2500m is the best height and length is 1Km and more low. A then the length is 1000m which is better one. The middle one is B and C which is considered the best attack position for missile. It says that length of 1Km and height of 2.5Km and 2Km is the predicted best positions in simple linear equation. As seen in Figure 3 (b) in quadratic equation at missile attack the parameter a will incline with inclining height. Meantime the highness of a will happen when the length inclines from 0.5Km to 2.5Km in fighter. The best way to control is length with 2Km while the worst one is 6Km in quadratic equation. The fitted position is 2Km of height and 2.5Km of length. As seen in Figure 3 (a) the parameter a will decline with inclining length. Meantime the highness of a will happen when the height inclines from 1Km to 2.5Km in less than 2Km length in fighter. If height declines after length is more than 2Km it becomes a negative one. It expresses that the high length and low height is more accuracy in later.



(a) L and a



(b) H and a

Figure 3 parameters of a in quadratic equation at missile attack

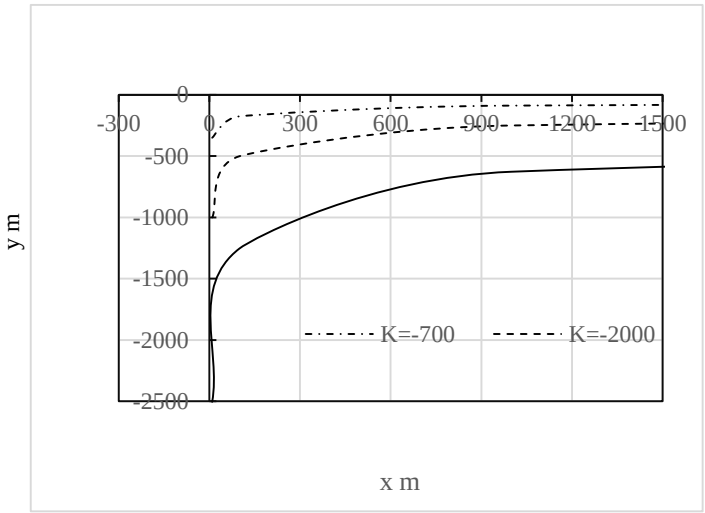


Figure 4 coordinator with parameters of K in exponential equation at missile attack

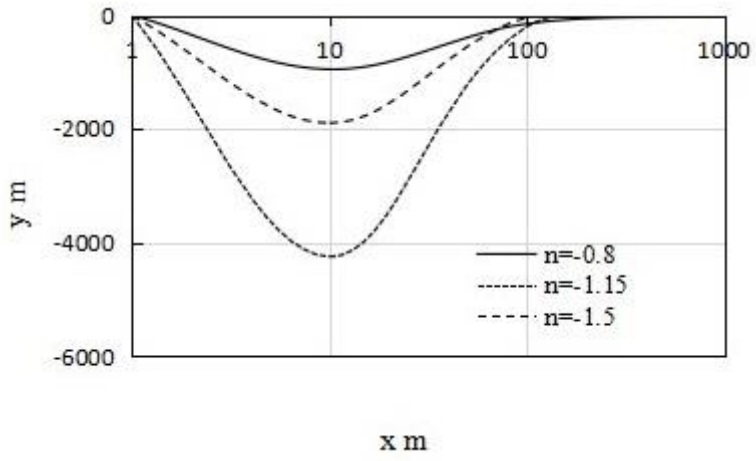


Figure 5 coordinator with parameters of n in exponential equation at missile attack

As seen in Figure 4 and 5 the n and K is drawn according to different parameters in exponential equation. The difference has been found while the negative n and K is used here since the appositive draw is erected. |K| increases the| y| increases while |n |is 1.15 the |y| summits. The accuracy is big with regulating n and K.

3. Conclusions

From above two methods it is simulated that relation between a & b、n&K and H、L with simple、quadratic and exponential equation. According to H and L the n and K is determined and its curve is made to observe respectively. L equation usually is curve while H equation is linear. The accuracy is the finest at parameter K of exponential equation while it is the lowest at simple equation and parameter n of its equation. The length of 1Km and height of 2Km and 1Km is the predicted best positions in simple linear equation. The length of 1.5Km and height of 2Km is the best position in exponential equation. And then the length of 1Km and height of 1.5Km is the second best position in it too.

The difference has been found while the negative n and K is used here since the appositive draw is erected. |K| increases the| y| increases while |n |is 1.15 the |y| summits. The accuracy is big with n and K.

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