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AIMING PROCESS ALGORITHMS AND ALGORITHMS DETERMINING THE SECOND INITIAL MOMENT OF BOMB DROPPING ERROR

Ognyan STOYKOV, Milen ATANASOV

"Aviation"Faculty of "Vassil Levski" National Military University
Dolna Mitropolia, BULGARIA

Abstract: *Algorithms solving the aiming task and its precision for the already existing methods and the unified bomb dropping method are created*

Keywords: *unified method, algorithm, bomb dropping, precision*

1. INTRODUCTION

Aviation combat activity effectiveness depends on the precision of the aiming at ground and air targets task solution.

The advancement and modernization of the Aviation Aiming System (AAS) concerns the methods used to solve the aiming tasks, the algorithms and their precision, determined through the mathematical expectation and the average quadrantial aiming error.

The method of mathematical modeling used for the research and precision assessment consists of giving a math description of the aiming process, presentation of the process with algorithms and its computer modeling.

The model of the aiming process consists of the type of aircraft, the pilot, the AAS, the bomb and the atmosphere.

While choosing the quality criterion, the characteristics of the tasks to be solved and the combat use range conditions of the designed system are taken into consideration. Generally the system is optimized on the basis of the condition providing the extreme value of the average risk[2]. i.e.

$$R=M[L(У, У_{id})]=\text{extremum}. \qquad (1)$$

As a quality determiner of the second initial moment of the system error is chosen:

$$\alpha_\varepsilon(t)=M[E^2(t)]=m_\varepsilon^2(t)+D_\varepsilon(t). \qquad (2)$$

The necessary probability characteristics can be acquired through multiple repetition of the experiment, observation of the exit variables of the examined system and processing of the observation results. Statistical test method of dynamic models allows nonlinear dynamic systems to be examined regardless of their complexity.

2. ALGORITHMS

In [3] a description of the existing methods used to solve the task of aiming in bomb dropping (Indication of the Fall Point – IFP and Indication of the Release Moment- IRM) is given. An algorithm of the aiming process of bomb dropping is developed on the basis of these methods.(Fig.1)

In [4] a unified method of bomb dropping aiming task has been created and is presented here.

An algorithm of the aiming process related to the unified method is developed. (Fig.3)

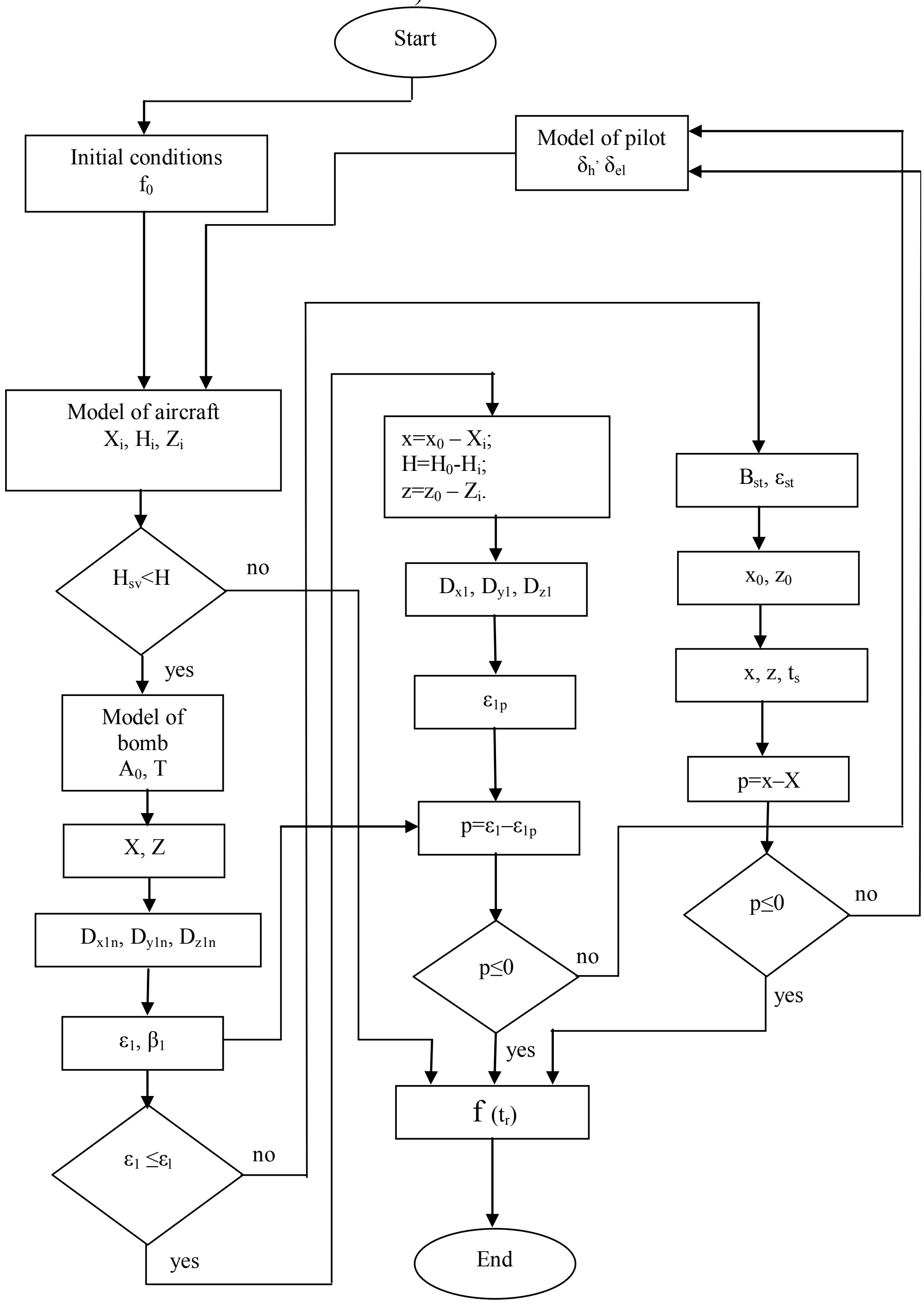

Fig.1. Algorithm of the aiming process in bomb dropping with the use of IFP and IRM

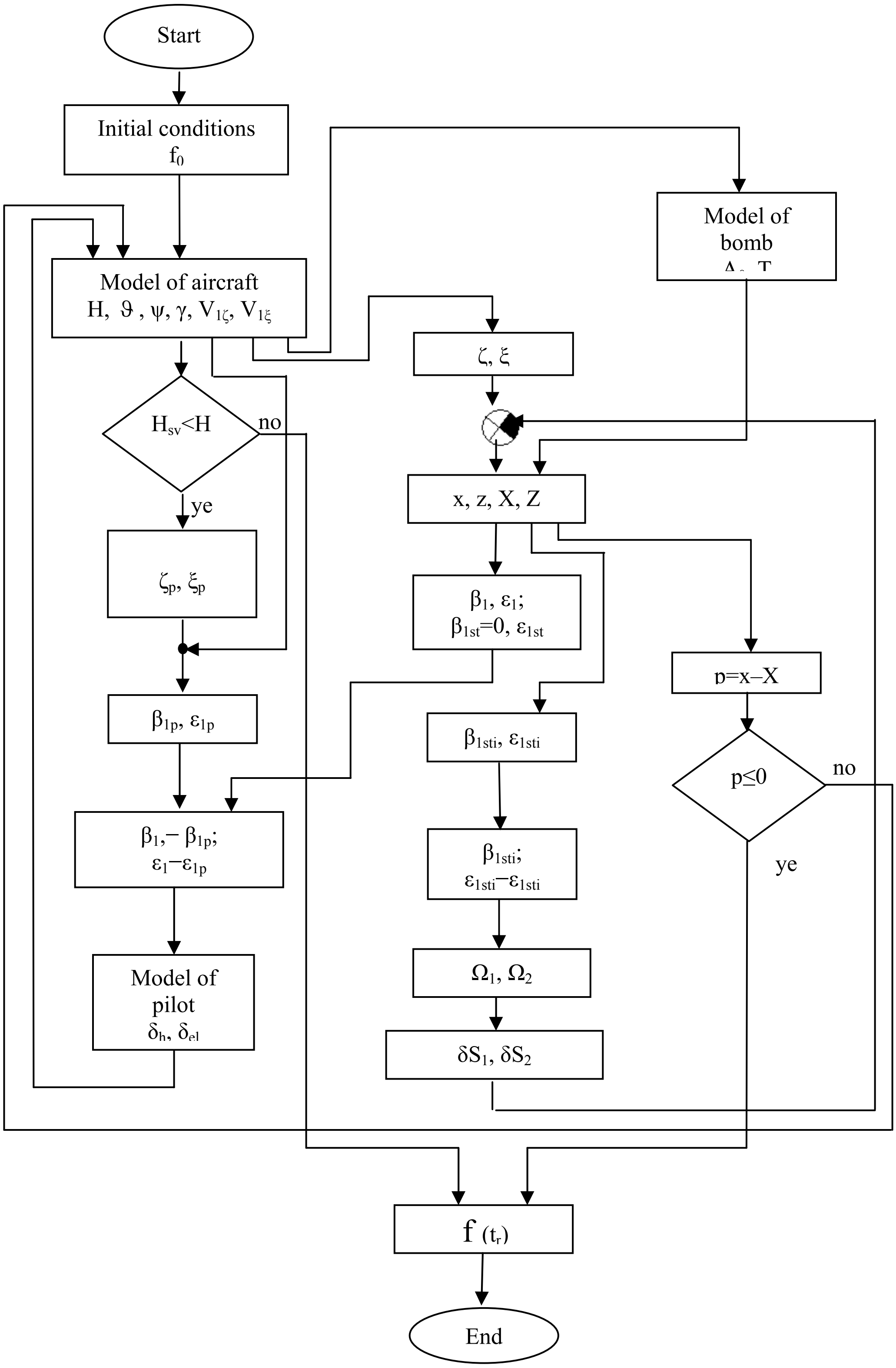

Fig.2. Algorithm of the aiming process in bomb dropping with the use of the unified method

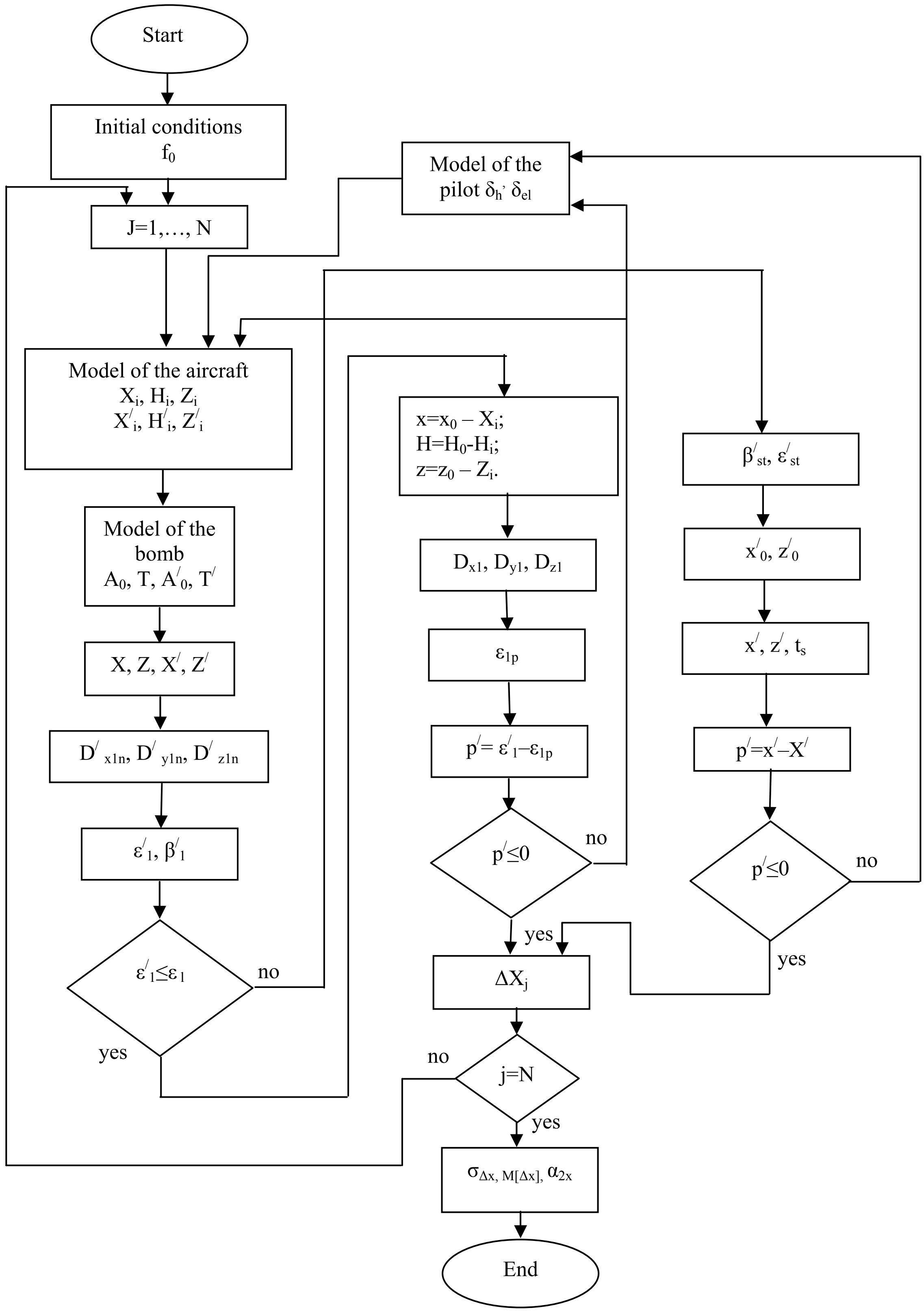

Fig.3 Algorithm for determination of the second initial moment α_{2x} of bomb dropping error with the use of IFP and IRM methods

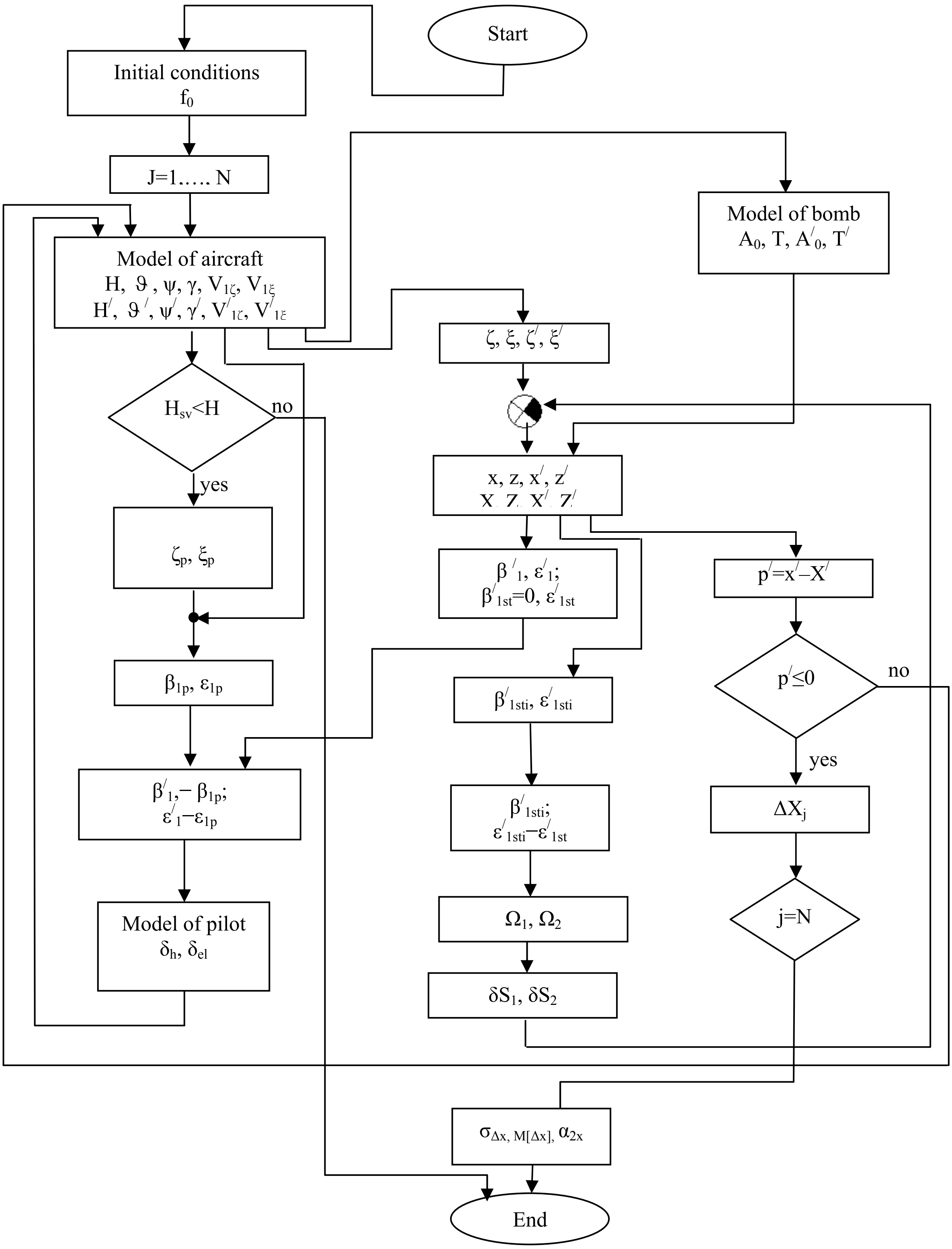

Fig 4.Algorithm for determination of the second initial moment α_{2x} of bomb dropping error with the use of the unified method

It is accepted that errors in the measurement values follow a normal law of distribution in order to determine the precision of bomb dropping. [1].

For the measured value $y_j(t)$, a random number ξ_{yj} is generated and it has a normal law of distribution with numerical characteristics $\sigma_{\xi yj}$ and $M[\xi_{yj}]$.

For time t the measured value $y^/_j(t)$ is determined by the equation:

$$y^/_j(t) = y_j(t) + \xi_{yj} \quad (3)$$

If IFP or IRM are used, the moment of bomb dropping is determined by the following equations:

$$p^/(t) = p^/ = \varepsilon^/_1 - \varepsilon_{1p}. \quad (4)$$

$$p^/(t) = x^/(t) - X^/(t), \quad (5)$$

and for the unified method, the moment is expressed with the equation:

$$p^/(t_п) = x^/(t_p) - X^/(t_p). \quad (6)$$

When $p^/(t) \leq 0$ condition is fulfilled the error in bomb dropping ΔX can be determined:

$$\Delta X = x(t_p) - X(t_p); \quad (7)$$

The algorithms used to determine the second initial moment α_{2x} of the bomb dropping error for the IFP, IRM and the unified method in preset initial conditions f_0 are shown in Fig.3 and Fig.4 correspondingly.

3. CONCLUSIONS

A research on the aiming process for the different methods has been carried out; the second initial moment of bomb dropping error has been calculated (for different bomb dropping conditions) and a comparative analysis has been done on the basis of the developed algorithms.

The relative increase of bomb dropping precision (the second initial moment of error) of the unified method compared to the existing methods is between 16% and 70% in straight and level flight bomb dropping. In dive the relative increase of bomb dropping precision of the unified method compared to the precision of the existing methods is between 15% and 68%.

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