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## Schematization of loadings and errors arising thus in estimates of crack growth duration

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### Abstract

The general block diagram of crack growth modeling and periodicity of aircraft elements controlling was worked out. The major factors determining the size of calculation inaccuracy  $\varepsilon_N$ , under calculations of the crack growth duration  $N_*$  and the inspections intervals  $\tau_0$  was marked and estimated with the help of the diagram.

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The Procedure of the fatigue life modeling and the control periodicity consists of three parts (Fig.1) [1]. The first part includes the choice and the development of a loading model using in tests and calculations (unit 1 on the Fig.1). The ratio error  $\varepsilon_L$  appears in this part. see Fig. 2.

The second part includes the development of the mathematic model of crack growth and the methods of its solution (units 2...13). In this case appear errors connected with inadequacy of model itself  $\varepsilon_k$ (unit2), errors of parameters estimation  $\varepsilon_n$ ,  $\varepsilon_c$  (unit 8), inaccuracy in consideration of operation condition  $\varepsilon_d$  (unit 9).

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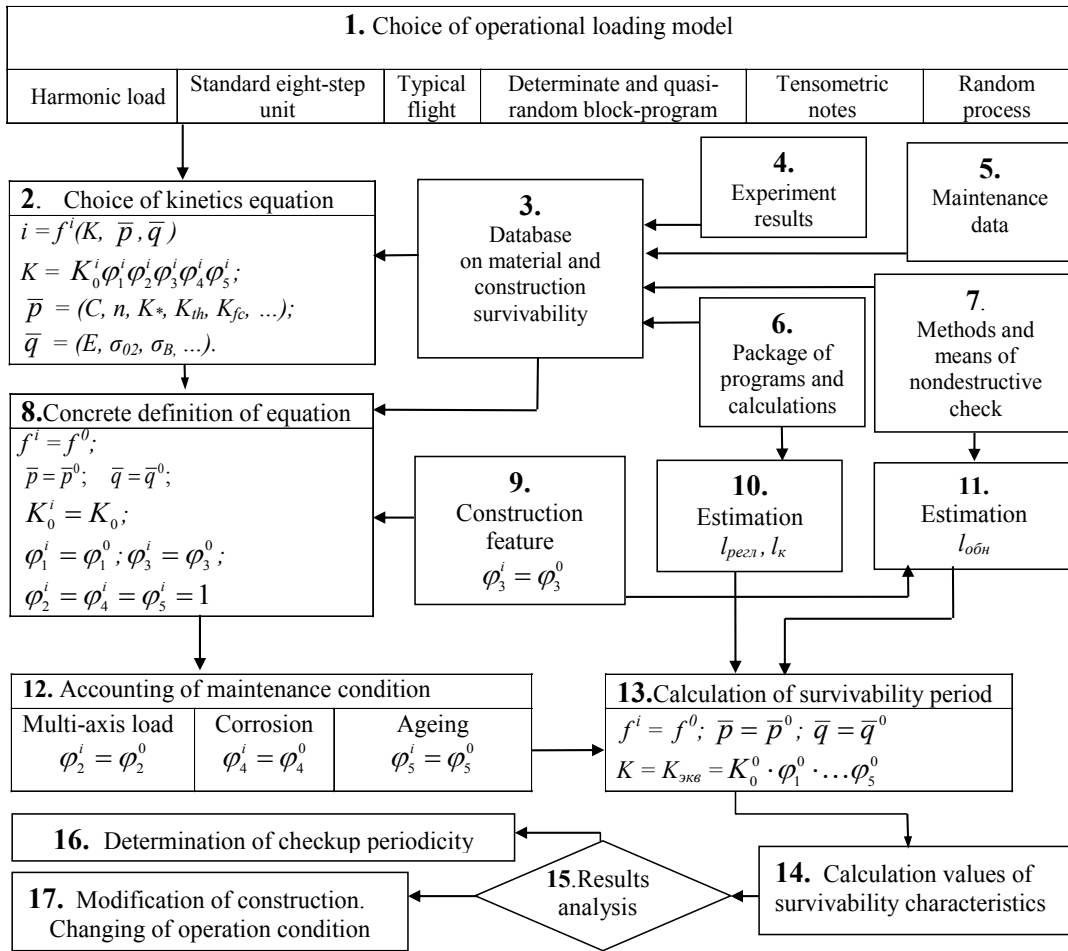


Fig. 1. The block diagram of the modeling of crack growth duration and control periodicity

The third part includes the development of procedure of estimation of periodic inspection of aircraft construction elements (unit 15-16). The definition of surely detected crack (with the 0.95 probability)  $l_d$  is used there (unit 11).

Generally listed above errors is difficult to estimate, however can be done some recommendations for the increasing of the calculation accuracy of fatigue life

Let's divide this task. In the beginning it is necessary to estimate the error caused by replacement the real loading spectra of aircraft design and its model by block-program. Then it is necessary to define the error introduced by crack growth equation itself. However it is practically not possible to do it without tests data on cyclic crack resistance and aircraft design elements under loadings with variable amplitude. The methodical error brought by simulation of operational loading by the block program, mainly is defined by distribution of amplitudes and to a lesser extent an average of process and its standard deviation [2].

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