IMITATIAL MODELING OF CONDITION THE POWER BLOCK

A. Z. Muradaliyev, T. K. Rafiyeva

ASRI of Power and Power Design

ABSTRACT

The new method of modeling of a condition power blocks, based on joint application of a method of modeling of casual events and method of modeling of casual processes is developed.

Keywords: method, modeling, power, application, substantiation

I. INTRODUCTION

The automated decision of a line of practical tasks, as forecasting of the basic industrial parameters State district electric stations as a whole and separate power blocks (PB) on various intervals of time (year, month), estimation of probability of performance of the diagram of loading and necessary size of an operative reserve of capacity, the substantiation of the requirements to removed in a cold reserve PB, provides an opportunity of adequate modeling of condition PB.

The basic method used at modeling of condition energy equipment, is the method of statistical tests [1]. The essence its consists that the various condition by a casual image are played on the basis of functions of distribution. The modeling of condition PB by analytical methods meets serious difficulties caused by set of possible condition and their difficult interrelation. The statistical modeling can be organized both at a level of casual events, and at a level of casual processes. The initial information at modeling at a level of casual events (condition PB) is the probabilities of display of these events, and result of account - casual sequence of events. The initial information at modeling at a level of casual processes are the functions of distribution of intervals between the same events and function of distribution of duration of course of these events, and result of account - casual sequence of intervals between events. If the simulated events are dependent, this dependence should be reflected in simulating algorithm. Variety and interrelation of events, dynamics of change of parameters the describing events, in time not only create significant difficulties in algorithms of real laws, but also cause, as a rule, private character of the developed programs.

II. MAIN PART

Many marked difficulties it is possible to avoid if to use both methods of modeling. At a level of casual events to simulate a type of a condition, and at a level of casual processes - duration of a condition.

The statistical estimations of relative meanings of total duration of condition and statistical functions of distribution of realizations of duration of condition can be calculated on the data of experience of operation for a line of years of observation. Designations them, accordingly, through and with i = 1, where - number of condition PB. As, the set 0 with i = 1, can be submitted as a line of frequencies of condition PB. For fixed, though also of any sequence of condition sequence of the condition (SC), we shall calculate an integrated line of distribution of total duration of condition $F(\delta\tau^*_{\Sigma,i})$.

Thus size we shall define under the formula:

$$F_i(\delta\tau^*_{\Sigma}) = \sum_{j=1}^{i} \delta\tau^*_{\Sigma,j} \qquad (1)$$

$$F_1(\delta\tau^*_{\Sigma}) = \delta\tau^*_{\Sigma,1}$$

$$F_{m_S}(\delta\tau^*_{\Sigma}) = 1$$

As an example in table 1 the estimations of relative duration of condition PB 300 Mvt, working on gas-oil fuel is given.

The basic reason inadequacy of simulated realizations of a sequence of condition PB of a real sequence of condition by existing methods are the initial preconditions (accident and independence of condition), when it are not taken into account:

- determined character scheduled (average and capital) repairs;
- dependence of probability of condition on parameters of individual reliability PB;
- interrelation of condition PB;
- dependence of probability of condition on a season.

At the automated forecasting of the basic industrial parameters PB, which scheduled repair is not stipulated, a line of distribution of probabilities of condition can be received by transition to conditional probabilities of condition.

The conditional probability i- s of a condition provided that a condition j is impossible, pays off under the formula:

$$\delta\tau^{**}_{\Sigma,i} = \frac{\delta\tau^*_{\Sigma,i}}{\sum_{\substack{\nu=1 \\ \nu\neq j}}^{m_S} \tau^*_{\Sigma,\nu}} \qquad (2)$$

$$\delta\tau^{**}_{\Sigma,j} = 0$$

And line of distribution of conditional probabilities of condition - under the formula (1)

If on considered PB the realization of scheduled repair work is provided, the modeling of the SC will be carried out on intervals of time before repair. Otherwise (the scheduled repair is not stipulated) - on all the given interval of time. The objective character of realizations in this model entirely concerns only to complete conformity to the real statistical data. The reflection distinction of parameters of reliability PB can be achieved by transition from the average meanings of relative total duration of condition all PB $\delta\tau^{*}_{\Sigma,i}$, to relative total duration of condition everyone PB and from the average distributions of duration of condition all PB $F(\tau_i)$ to distributions of duration of condition everyone PB.

Despite of casual character of emergency condition, and condition of a cold reserve concrete PB, probability of transition from a working condition in a condition of restoration at sudden failures, or in a condition of a cold reserve are various. From a condition of a reserve the transition in a condition of restoration is impossible at sudden failures, and furthermore - again in a condition of a reserve. The interrelation of condition can be taken into account by conditional probabilities of occurrence of condition in the matrix form.

To exclude the specified discrepancies of modeling, we shall take advantage of that part of the information of a matrix of change of condition, which does not depend on number of condition. Namely - indication on possible adjacent condition. If the adjacent conditions are possible, in a cell of a matrix we shall put down 1, otherwise - 0. Let us name this matrix - as a matrix of transitions (MT). For the condition, entered into consideration, (see tab. 1) MT is brought in table 1.

The large advantage of application of a matrix of condition of distributions $F_i(Q^{*}_{i,j})$ is the increase of objective character of realization of the SC. In particular, at modeling the SC the impossible condition are excluded adjacent same and practically, and the probabilities of transitions from one condition in another are adequate observable on practice. One of the most important and difficult questions at modeling the SC is the account of dynamics of change of probability of condition in time. The earlier accepted assumption of uniform distribution of condition on the given interval of time not always corresponds to practice.

Table 1

Matrix of transitions (MT)

Type Condition	Conditional number of the subsequent condition								
	1	2	3	4	5	6	7	8	9
Working	0	1	0	1	1	1	1	1	1
Emergency idle time	1	0	1	0	0	1	1	1	1
Failure at start-up	1	0	0	0	0	1	1	1	1
Repeated failure	1	0	1	1	0	1	1	1	1
Sudden unhooking.	1	0	1	0	0	1	1	1	1
Emergency demand	1	0	1	0	0	0	1	1	1
Cold reserve	1	0	1	0	0	1	0	1	1

The further increase of adequacy to the simulated SC is reached by use of the mechanism of specification of probabilities of occurrence of condition after everyone playoff such as a condition.

III. CONCLUSION

1. The process of change of condition power blocks is characterized by an opportunity of formal transition from one non-working condition in another; witch promotes reduction of number of switching-off (start-up). The number of such changes of condition, on the average, makes about 20% from number of non-working condition. The application of known methods of modeling of condition does not allow taking into account these features.
2. The new method of modeling of a condition power blocks, based on joint application of a method of modeling of casual events and method of modeling of casual processes is developed. The method allows:
- exclude modeling adjacent same condition and impossible combinations of adjacent condition;
- take into account statistical interrelation of condition;
- take into account laws of change of condition in a season.
3. Modeling inadmissible combinations of adjacent condition is prevented on the basis of a matrix of transitions.
4. The interrelation of condition is displayed by transition to conditional probabilities of condition and correction of relative duration of condition on a residual interval of modeling.
5. The dependence of probability of occurrence of condition on time is taken into account by consecutive modeling of condition on intervals, for which this dependence can be neglected.
6. On the basis of algorithm of modeling of condition power blocks the algorithm and program of forecasting of guaranteed estimations of the basic industrial parameters both for State district electric stations as a whole, and is developed for separate power block.

REFERENCES

1. *Rudenko Y.N., Ushakov Y.A.* Reliability of power systems. M.: Science, 1986.(in Russian)