Complex Modeling of Electronic Devices Production Systems Quality Maintenance

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***Abstract* — The approaches to the production systems through mathematical models of radio electronic devices quality maintenance are described.**

I. Introduction

THE solution of competitive production manufacturing problem is possible only by the way of advanced development implementation into the production process. Among such systems are technological, metrological and production complexes assigned for the proper procedures implementation. The studies have shown that there isn't the general technique of production process through modeling in aspect of products quality assurance [1-2].

II. Problem formulation

Quality maintenance system S may be considered as some low-level subsystems set S_i, $i=\overline{1,m}$, each of them is active on the appropriate stage of technological process:

$$S=\langle S_1(S_{1,1}, S_{1,2}, \dots S_{1,n}), S_2(S_{2,1}, S_{2,2}, \dots S_{2,n}), \dots \\ \dots, S_m(S_{1m,1}, S_{m,2}, \dots S_{m,m})\rangle, \quad (1)$$

$S_1, S_2, \dots S_m$ – second level subsystems ;$S_{1,1}, S_{1,2}, \dots S_{1,m}, \dots S_{m,1}, S_{m,2}, \dots S_{m,m}$ – first level subsystems. S – macro model of process; $S_1, \dots S_m$ – local models; $S_{1,1}, \dots S_{m,m}$ – micro models (Fig.1.).

Numerical ratio of different levels systems is determined by structural peculiarities, by technological process complexity, by his decomposition principle and by another factors. It is obvious that in such situation mathematical models need to be isomorphic not only due to some one process but to all level process.

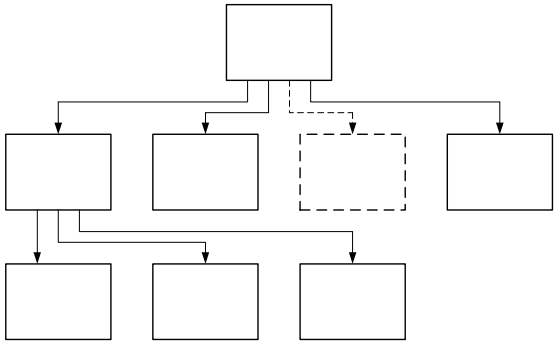

Fig 1. Assurance system formalized structure.

Also they need to be abstractive and be possible to describe quality forming process on all production stages [1, 2].

Quality functional criteria

availability criterion:

$$G_{AV}: \bigcap_{\kappa=1}^{n}\bigcap_{i=1}^{n}(X_{k,i}\in\{X_{k,i}^{\lim}\}), \quad (2)$$

optimality criterion:

$$G_O: \bigcap_{k=1}^{n}\bigcap_{i=1}^{n}(X_{k,i}\in\{X_{k,i}^{\lim}\})\bigcap\bigcap_{k=1}^{n}\bigcap_{i=1}^{n}(X_{k,i}\in\{X_{k,i}^{opt}\}), \quad (3)$$

$\{X_{k,i}^{opt}\}$ - parameters quasi-optimal values set.

inaccessibility criterion:

$$G_I: \bigcap_{k=2}^{n}\bigcap_{i=1}^{m}(X_{out.k-1,i}\in\{X_{out.k-1,i}^{\lim}\})\bigcap\bigcap_{k=2}^{n}\bigcap_{i=1}^{m}(X_{in.k,i}\in \\ \in\{X_{in.k,i}^{\lim}\})\bigcap\bigcap_{\kappa=2}^{n}\bigcap_{i=1}^{m}(X_{out.k-1,i}<X_{in.k,i}); \quad (4)$$

statistical fitness criterion:

$$G_S: \bigcap_{k=2}^{n}\bigcap_{i=m+1}^{p}(X_{out.k-1,i}\in\{X_{out.k-1,i}^{\lim}\})\bigcap\bigcap_{k=2}^{n}\bigcap_{i=m+1}^{p}(X_{in.k,i}\in \\ \in\{X_{in.k,i}^{lin}\}\bigcap\bigcap_{k=2}^{n}\bigcap_{i=m+1}^{p}(X_{out.k-1,i}\in\{X_{in.k,i}\}); \quad (5)$$

exceeding criterion:

$$G_E: \bigcap_{k=2}^{n}\bigcap_{i=p+1}^{s}(X_{out.k-1,i}\in\{X_{out.k-1,i}^{\lim}\})\bigcap\bigcap_{k=2}^{n}\bigcap_{i=p+1}^{s}(X_{in.k,i}\in \\ \in\{X_{in.k,i}^{\lim}\}\bigcap\bigcap_{k=2}^{n}\bigcap_{i=p+1}^{s}(X_{out.k-1,i}>X_{in.k,i}\}, \quad (6)$$

$m+p+s=n$ – total number of jointing parameters; m, p, s -number of parameters which are dominant for inaccessibility, statistical fitness and exceeding conditions.

quality economic criterion:

$$G_E: \bigcap_{k=1}^{n}\bigcap_{i=1}^{n}(C_{1,i}<C_{1,i}^{\lim})\bigcap\bigcap_{k=1}^{n}\bigcap_{i=1}^{n}(C_{2,i}<C_{2,i}^{\lim}), \quad (7)$$

III. Conclusions

The approach to the quality maintenance production systems stochastic modeling, estimation and optimization was considered. High adequate quality functional criteria were proposed.

References

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