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INFORMING KNOWLEDGE CONTROL OF COMPUTING DESIGN OF FLEXIBLE MANUFACTURING SYSTEM

Mahammad Ahmadov, Javanshir Mammadov, Agil Huseynov

Sumgayit State University, Sumgayit, Azerbaijan
cavan62@mail.ru

At present, for raising intelligence level, more speedily and efficiency solution of computing design problem of flexible manufacturing system (FMS), on all stages design of knowledge control system of information support are used [1, 2]. Organization of knowledge control system is specialty technology on the base of software complexes, demanded solution of all problem of knowledge control.

At development of information support of computing design the process of knowledge control includes the following set of the problems: knowledge assemble – knowledge extraction and collection about FMS composes structure, its active elements of FMS, which is controlled; knowledge organization and structuring FMS active elements attributes, their technological operation and connection between them, which is necessary for efficiency control; correction, restoration, edition of new and old knowledge about designed objects of FMS; knowledge delivery about FMS prototypes, functioned industrial robots, manipulators and automatic conveyer needed consumers; organization of concrete agent – designers to knowledge and organization of interface; organization of intelligence search and option of necessary designing information, new knowledge creation [1].

The model of informing support organization of FMS computing design, where knowledge control being one of the function is considered as intelligence agents set [4]. Connections between agents allow all intelligence agents set in whole to follow by the purposes and to solve the problems of FMS computing design operation and procedure organization. Each agent have an individual purpose ($Ag_i \rightarrow W_i$, where $Ag_i \in$ agent set, worked upon the design; $W_i \in$ purposes set, suited agents) and solve special round of FMS active elements designing problems, where are used the own knowledge and exchanged knowledge with other agents [5].

FMS design process control depends on professional level and individual quality of designers. Knowledge control service functions in the area, where basic agents are designers, organization chief (as an user and controlling structure), information technology realization service and external knowledge source. Its purpose is efficiency gratifying necessity of users with needed knowledge, but the problems are defined with set of knowledge control process.

Number of the made design operations and their successiveness at knowledge assembling depends on many factors. Knowledge assembling FMS and its active elements computing design is begun of search of data, information from the existing data base. At search the preliminary information about attributes and other parameters of FMS is used. The common scheme of computing search organization can represented in the view following algorithm [2, 3]:

< search and option > : : = < search form >, < search object >, < search condition >
< search form > : : = < documental > , < fact graphical >
< documental > : : = < bibliographical >, < bibliotheca' s >
< bibliographical > : : = < information about technical engagement by FMS and its active elements >, < first documents position >
< bibliotheca' s > : : = < information about first documents in corresponding fond >
< fact graphical > : : = < view of fact graphical search >
< view of fact graphical search > : : = < the set of active elements of FMS
($\forall$ $A\Theta_j \in$ active elements ГПС) >,
< the number of FMS active elements >,

< technical characteristics of active elements ($\forall$ TX_{ij} $\in$ technical characteristics of FMS active elements) >,
< successiveness of technological operations of FMS active elements ($\forall$ TO_j $\in$ technological operations of FMS active elements) >,
< the set of FMS active elements > : : = industrial robots (IR_i) | | automatic conveyers (AC_i) | technological units (TU_i) |.

< number and types of active elements in flexible computing islands (FCI_j) FMS ($\forall$ NT_{ij} $\in$ number and types of active elements) > : : =

< successiveness of technological operations of FMS active elements >
< an object search > : : = < information about FMS >
< information about FMS >: : = < FMS composes structure >, < constructive parameters of active elements in corresponding the official documents demands >, < mathematical calculations of the basis parameters of active elements >.
< search conditions > : : = < goal' s limits for FMS active elements (AE) option (extr{AE load-liftingness, AE speediness, AE productivity}>, < goal' s limits for FMS composes structure option (extr {area of FMS and each FCI relocation, productivity FMS and each FCI, FMS and each FCI control system reliability } >.

Search conditions lower a search area, what rise suitable search efficiency. The result of designer search can be set included some elements or composes structures of FCI and FMS. Option of a demanded element (industrial robot, technological unit) or composes structures of FCI and FMS is existed by means of analyze and solution of extremely deduction of option of purpose function and limitations.

Further operations of data option, some information and knowledge assembling are existed. The last operations of knowledge assembling are filtration and integration of the assembled knowledge in knowledge store base. The filtration operation includes cleaning and transformation to demanded format of data, information and knowledge and their preparation for loading in knowledge store base.

Search operations of source, their getting, option and data, information and knowledge filtration demand processing before assembled and outputted knowledge [3]. At search operation performance of source electron post, faxes, internet and other communications units services are used. Except the presented knowledge assembling some information coding and their relocation in knowledge store base include. The project's documents, the received solution and prototypes can be coded. All coding process and knowledge store can use again in future.

At presence of alternative design solutions {*DSi*} set a such *DS* is selected, which would be gratified to manufacture demands. The purpose function is defined by a designer [2].

$$W = F\,[f_1(z),\ f_2(z),\ldots\ldots,\ f_n(z)],\quad z = \{z_i\},\quad i = \overline{1,n}, \qquad (1)$$

where z – the set of design solution received at design procedures {*DPi*} performance; F – the received view of design functional quality; $f_1, f_2, \ldots f_n$ – the functions, presented itself private criterions of design quality, which are got concrete number values in dependence of an argument value z.

At option of optimal design's solution of FMS, physical meaning f_1 – time of designing works performance. Limitation can determine in the following: time of finishing a stage of the technical proposal by FMS composes structure option and its manufacture islands at *k'*s option must not over the before installed time [2]:

$$t_i^k(z_{1j}) \le t_i,\quad i = \overline{1,m}, \qquad (2)$$

where $z_{11}, z_{12}, z_{13}, z_{14}, z_{15}, z_{16}$ – are suited time's spending on composes structures design $FCI_1, FCI_2, \ldots, FCI_6$. In this case the summing time, spent on composes structures design would be have the following view [2]:

$$t_i^k(z) = \sum_{i=1}^{6} z_{1i} \le t_i \quad . \tag{3}$$

At designing of the FMS composes structures option model in depended on cost's spending f_2 can presented as following:

$$S_i^k(z_{2i}) = \sum_{i=1}^{6} z_{2i} \to \min \quad , \tag{4}$$

$$\text{где} \quad z_{2i} = p_i q$$

where z_{2i} – designing spend at each FCI in FMS design; p_i – work volume of design with i 's FCI option, people-year ; q – year's profit of a designer.

The knowledge organization and structuring process is defined by purpose installations of the created knowledge control system. In any knowledge control system creation of rational structure of them storing, organization of rules and reformation and use events. Even in more primitive knowledge store – library, knowledge source must be relocated, systemized, catalogues are created, application rules in knowledge must be developed.

The methods of control system of FMS computing designing knowledge depend on the exists paper's and electron's documents, electron message, the existed data base, precedent's library and other documents of CAD. Paper's and electron's documents, included into the production and administrative management, present knowledge control system a like of documents syntheses on the base of knowledge no contained in the accounts and technical documents, and stored as now – chow at organization experts; improvement of work of manufacture problems organization. Application of engineering knowledge methods [1] in the group's work helping allowed to create a system, worked with knowledge, which have been got control system of FMS computing design knowledge.

At solution of support and improvement of knowledge control system of FMS computing design, at first the results of efficiency definition of the existed system are necessary to use. On that circle stage of knowledge control the problems are solved connected with addition of new knowledge, removal or modification of the elderly knowledge, the coordination problems of occupation of knowledge control system. Some of these problems are actuality already on the stage of knowledge control system creation. Except, as organization as technical problems allow to develop the system. As on the creation stage as on the development stage the problems getting from people conflicts can appeared.

Improvement of knowledge control system of FMS computing design depends on also the method of knowledge assemble and developers, exploitation and users service. The system improvement must execute in continue and is included the system administrator function worked with users.

The following types of knowledge relocation are differed: automatically knowledge relocation between potential consumers, where in that case knowledge is passed as individual documents; the potential users have possibilities an access into knowledge store, that is, such a type of knowledge relocation has preliminary store of knowledge (documents) in library or Web-server for access across the internet net, source search and knowledge option from the information store. That operation can be used at work in local net and corporative net organization. Knowledge transformation from one to another personal is appeared by knowledge exchange among no formal groups and by formal learning and training.

For supporting quality and effective service of users the work methods with knowledge, oriented on each users group and universals instrumental units of work with knowledge, are used.

The base of knowledge productivity process is creation of a new knowledge variant included: a) analyze and filtration of the early got knowledge; b) correction of the early outputted knowledge; в) new knowledge creation. To create a hypothec the existed knowledge are necessary to use already. Thus, application the early possessed knowledge is an important condition for creation of a new hypothec. Before creation of hypothec operation of knowledge source search and option in the informing store is executed. The created hypothec is tested by

criterions, defined in knowledge control system. Criterions option – one of the important factors influenced on efficiency of all knowledge control at computing design of FMS. The tested and no tested hypothecs are stored in the archive. Before finale hypothec option for including it into knowledge information store ranging of concurrence hypothecs.

At knowledge output by FMS computing design after a solution operation the results saving is executed. Knowledge output process depends on much degree of saving efficiency. Also it depends on use form of preceding knowledge at executive of all operations included into knowledge output process.

Specify of designing FMS demands some modification of the model, where users of the proposed model's control system knowledge's users are three group of agents: design developers are included into the first group (constructor, technology user); specialists by concrete designing unit are members of the second group; people of controlled functions are members of the third group (quality control, ecology specialists).

The presented above is procedure part of knowledge control system of FMS computing design. Declarative's part of the system is expert's knowledge of designers. This part of the system is stored as data base: in electron archive the executed projects the knowledge as documents, supported abstract and quality description in process of FMS development, are used; there are some information about materials, theirs attributes and specialties as attribute – value pare in the archive; expert knowledge getting by the methods of individual experts or inductive methods by set of precedents; no formal description of knowledge control system of FMS computing design.

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