Computer modeling of intellectual movements of active elements

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Abstract

For the purposes of computer modeling of intelligent technological systems, directions for the development of the method of matrix description of active elements formulated. A matrix-topological interpretation of the basic structure of an active element in the component chain method is proposed. In the study of flexible manufacturing processes, abstract graphical representations of active elements are expressed as a two-dimensional matrix Z (2×n). On the example of dynamic movement systems, individual trajectories of movement of active elements are studied. A computer model of the states of interaction of active elements with each other created. In the technological systems under study, within the framework of artificial intelligence, a computer model developed to obtain the ability to study emergencies that may occur on the trajectory of each active element, and for accident-free control of the technological system. Visual representations with a dynamic structure formed by computer simulation of individual and complex projects based on the ideas and creativity of various specialists involved in the design process.

Keywords: active element, computer modeling, intelligent control, interactions, flexible manufacturing processes.

One of the main quality indicators in the design of active elements, which are dynamic structural components of flexible production systems, is the correct assessment of intellectual movements in their displacement trajectories. Designing both the design parameters of the active elements and the intellectual actions of the active elements by experts in the relevant field does not always result in the desired effect. Thus, given that the correct design of individual designer parameters of active elements and the actions of the system in the form of dynamic images have an important role in production efficiency, it is also necessary to have computer control of the complex and iterative design process.

At the same time, one of the main problems in the design process of active elements is the prevention of their accidents in an undefined obstacle environment.

On the other hand, an error made in the initial design stages can cause further errors in the subsequent design stages. The subsequent identification and elimination of errors made in multi-stage and iterative design creates a need for additional material resources along with time loss. Computer modeling proposed in order to prevent such negative situations in the design stages and to create visual images of the design process on the computer.

The activities of flexible manufacturing processes (FPM), a complex control system that creates its own constituent structure from active elements, take place in an environment of uncertainty. It should also noted that each active element itself is an elementary dynamic system that can be in different trajectory states.

In addition, when carrying out a complex technological operation, the active elements of the CIP have common work areas where conflict situations, that is, emergency conditions, often arise due to technological conditions with an incomplete information environment. Active elements with intersecting trajectories and obstacles that may arise along the trajectory can indicated as conflicting situations.

In the researched technological systems, as an issue of artificial intelligence, it is the development of a computer model for obtaining opportunities to investigate the accident situations that may arise in the trajectory of the movement of each active element, and for the proper management of the technological system. For the purpose of effective management of the technological process, a computer model proposed for the study of the possibilities of decision-making within artificial intelligence regarding the change of the movement trajectory of the active element (or active elements) due to the encountered obstacle (or obstacles).

Technological equipment, automatic transport systems, industrial robots, manipulators and other auxiliary

devices considered as active elements.
Let us study the working principle of the CHIP, which connects automatic transport systems, three manipulators, two robots.
Abstract graphical representations of the active elements of the investigated chip can expressed in the form of a two-dimensional Z (2n) matrix:

$$\boldsymbol{Z} = \begin{bmatrix} z_1 & z_2 & z_3 & \cdots & z_i & \cdots & z_n \\ r_1 & r_2 & r_3 & \cdots & r_i & \cdots & r_n \end{bmatrix}$$

Where 1≤i≤n; n- number of nodes; z_i- serial number of the mechanical node (connection) point of the node; r_i- the sequence number of the next node connected to the given node z_i in the first row of the matrix Z. And the mathematical form S of the connection structure of neighboring nodes
S= [Q, L] (2)
As can given Q is a scalar value that indicates the type of node. L - angle value between two neighboring nodes connected by a common node point.
Based on AQVB, abstract graphic models of the active elements of the investigated or newly designed chip are prepared on the computer based on the proposals of designers, automation specialists and other such experts.
Each active element is an elementary dynamic system individually, and they create situations of mutual actions (QHV) with each other. The structural composition of the NGO is intellectually controlled:
• Time sequence;
• Same direction sequence;
• Intersection;
• Difference
In the time-sequenced activity process, the operation performed on the active elements is performed after or before any operation. In this classification of QHV, there is no intersecting time interval in the trajectories of active elements.
At least two active elements can assigned in the same direction sequence, so that the trajectories of these active elements have actions directed to the same working area.
In the cross-trajectory classification of QHV, situations may arise where active elements pass through the same position coordinate in their trajectories.
In different trajectories of classification, there are no common intersections and interdependent waiting relationships along the movements of active elements.
In general, the classification of active elements by QHV
$K \rightarrow A : Q\,(M\;(p(x), L), r(T_0), VZ\;)$
A - Q here - the object description structure of the active element in the computer according to the proposal;
K - by taking an arbitrary one of the given quantifiers
$\forall x$ – "for discretion";
$\exists x$ – «for existence $!\,x$ – « only for; $x \in X$ »;

$x \rightarrow$ – displacement for individual x"; means.
x – an individual active element selected from the database of objects;;
M – $p(x)$ və L relations obtained from the comparison between;
$p(x) -$ p output or input values of the parameter of the object after the command;
L – the transition parameter compared with the p(x) parameter
$M\;(p(x), L)$ – facts;
$R(T_0)$ – considering point Tr = [t_1, t_2] time interval.

The expert-oriented opinions of management experts are formed into structured knowledge according to the mathematical formula (3), and a logical model of the knowledge base is built in order to conduct a computer experiment. In the creation of computer modeling software based on database (VB) and knowledge base (BB), respectively, the input data of VB is the parameters Z(2 □n) and S, and the input data of BB is the control structure based on (3) .

The effectiveness coefficient (γ) of the activities of the active elements on QHV can also be evaluated by running a computer model.

$$\Gamma = \frac{G(Q, w)}{G(k, q, w)}$$

Here - the number of active operations that perform information exchange with VB; - the number of actions of active elements with parallel action; - the number of actions of sequential active elements; - the time spent on making decisions to start the execution of activities between active elements; - the time spent on performing the activities of a number of active elements.

By determining the distribution of the active elements of the chip in their working areas {S1, S2, ..., Sj, ..., Sh}, they are grouped by mono and multi modes (Fig. 1.).

Here $1 \le j \le h$; h- total number of working areas.

Actions of active elements can be performed both in an individual field Sj and in one or more {Sz1, Sz2, …, Szv} worker fields. Here $1 \le zv \le h$.

In the mono mode, the software of the active elements of the chip of the same nature is prepared. The time sequence of QHV and different trajectories relationships are included in mono mode.

In Multi mode, multi-component software modules of activities simulating intellectual actions of common active elements of a large number of different working areas are created. The same directional sequence and intersecting trajectory relations of QHV are included in the multi mode.

The computer experiment design of the CHIP also simplifies its spatial structure modeling architecture, which differs from traditional modeling methods in terms of time. Computer experiments of events that change the states of the system in the proposed spatial structure modeling

S_t:X→(U,A,D),

Here S_t is the current state at time t; X - array of information about the current status of the active elements of the CIP; U - set of active actions to reach the final goal of the whole system; A - set of active elements performing operations during t; D is the correctness coefficient of the active actions occurring at time t and takes its value from the interval [0;1].

The study of the mechanical junctions of the active elements of the chip shows that the mathematical models of the mechanical functional junctions of the components of this type of systems have the same structure and differ only in certain constant values in each case. BB's constituent components are used to modify both mono and multi computer graphics representations of active elements. To the characteristic features of BB as well $P: \check{X} \rightarrow U_j$

Also inc ludes a production structured management module. Here P - rules for managing active elements; X ˇ – input information set expressing the position of active elements; Uj is the jth dynamic action performed, U is taken from the set of active actions.

Special variables representing symbolic representations of the characteristics of the functional-technological parameters of the active elements are included in the software, and a graphic-imitation image is created by creating a production structured model of the active elements on the computer with the execution of the software modules.

By applying a computer model, designers can select standard active elements from AQVB. If necessary, it can also perform constructive intellectual processes in the design of a new active element using AQVB.

Computer modeling software developed in the C# algorithmic language allows to build a structural model of the intelligent movement dynamics of a set of active elements in both mono and multi (Fig. 2.) Modes.

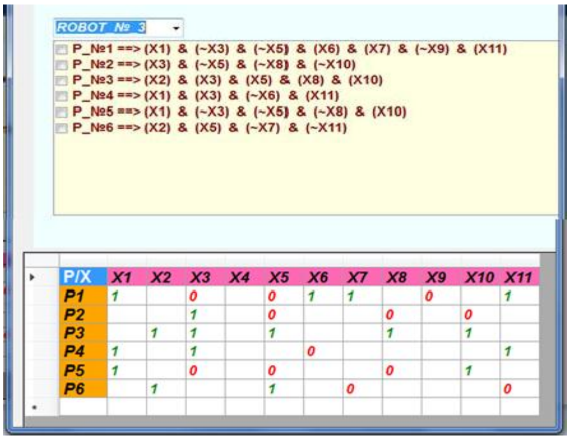

Figure 2. Multi-mode structural model

As the advantages of computer modeling, a knowledge base is established for the purpose of performing a visual image of the complex movement dynamics of active elements on the computer by determining the characteristic components of the system, whose intellectual control is initially prepared. Based on the combined structure, databases with graphic information of standard active elements of data and knowledge bases are created.

Conclusion

Computer modeling helps determine the factors that have a negative impact on the design process and eliminate them, which increases the effectiveness of the system. The practical importance is that the flexibility of modification operations in intellectual management processes is performed in a minimal time.

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