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MODELING OF UNIVERSAL K-DIGITAL STRUCTURES

G.G. Chetverikov, O.O. Tyshchenko, S.V. Zmiivska, O.V. Kurinnyi, I.U. Horovyi

Kharkiv National University of Radioelectronics

*chetvergg@gmail.com, lenatishenko95@gmail.com, svetazmiev@gmail.com,
ds.noob11@gmail.com, iggorovoy@gmail.com*

Chetverikov G.G., Tyshchenko O.O., Zmiivska S.V., Kurinnyi O.V., Horovyi I.U. Modeling of universal k-digital structures. Theoretical construction principles of spatial invertible multiple-valued elements and structures have been developed. The analysis of their practical application in information system with k-valued coding has been tested. All enumerated properties and functions in point of fact are essential not only are discrete on time, but also many-valued.

Keywords: K-DIGITAL INTELLECTUAL SYSTEM, MULTIPLE-VALUED LOGIC, ARTIFICIAL INTELLIGENCE.

INTRODUCTION

The basic construction concepts of many-valued intellectual systems (MIS), which are adequate to primal problems of person activity and using hybrid tools with many-valued coding are considered. With materialism of a point of view these concepts are agreed with the dialectic laws opened by a man and their manifestations in problems connected with creation of identification systems prediction and recognition of imagery in which the interactive operational mode is a main part of the whole complex of intellectual properties [1, 2].

Those are, for example, the law of unity and struggle of contrasts – as availability in parallel operating in space and time of mechanisms both discrete, and continuous mapping objects of plants; the law of transition from quantitative changes to qualitative-quantitative changes of gradation levels of brightness and the color result in qualitative changes in mapping of objects; the law of negation of negation – as a changes and alternation of coding indications of messages about objects in neurons of a brain – from space to temporal and from two-place to many-valued.

It is known [1,3] that the majority of mathematical modeling problems of the language information processing by man's activities is based on those or different methods of logical (predicate) equations solution. The last circumstance provides coding capability and the simplest morphological information processing opportunity in real time. The operation efficiency of the automatic information processing system in a natural language depends on both a representation method of the electronic dictionary, a coding data method in these dictionaries and transformation methods of natural language information, represented by the formal language (in the given case – the algebra of finite predicates).

CONSTRUCTION PRINCIPALS

Let us consider basic principles of multiple-valued invertible heterogeneous logic elements construction of the first and the second kind proposed in this paper. The elements of the first kind implement predetermined finite relation in the form of corresponding multiple-valued invertible heterogeneous logic elements and they are universal in fact. It should be noted that by "invertibility" is meant a scheme of the multiple-valued logic element. In these case this scheme is endowed with a

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capability both direct and inverted information transformation [2].

As the corollary, non-adequacy of used principles of coding and element basis to simulated processes entails a redundancy, complication and no evidence of used mathematical and engineering means of transformations [3], loss of a micro level of parallelism in handling expected fast acting and flexibility of restructuring without essential modifications of architecture and connections.

The originating complications [1], in creation of a many-valued intellectual system promote moving out of the adequacy concept of many-valued logic and structures of MIS creation problems with desirable properties and possibilities. Therefore, for disclosure of use paths of a knowledge backlog in the field of many-valued coding and structures in MIS creation the conceptual structurally functional model of a MIS cell (Fig.1) is offered.

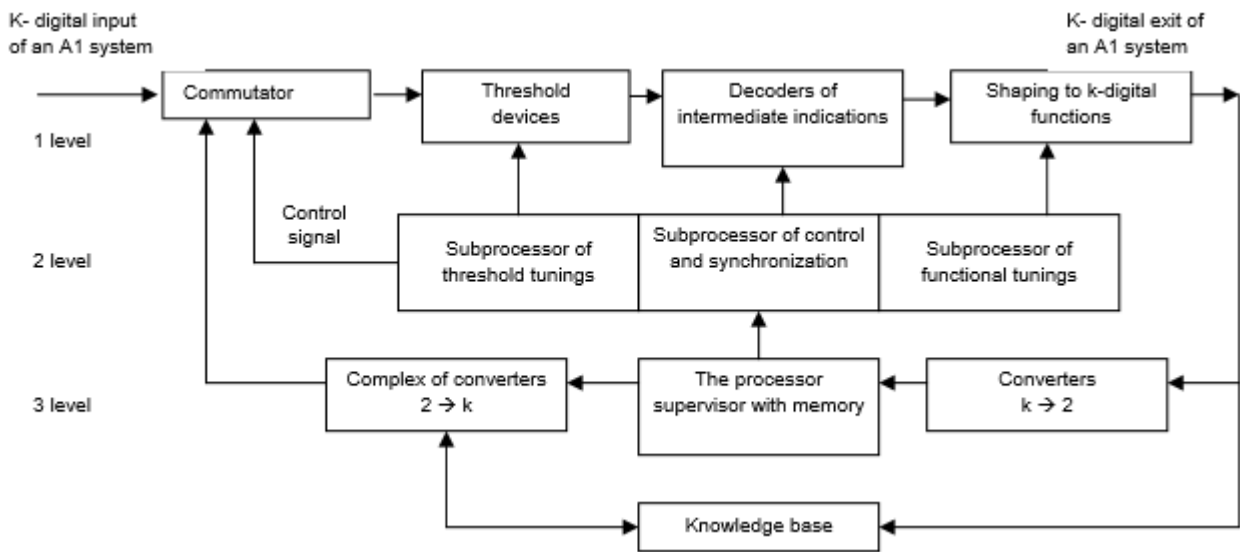


Figure 1. A conceptual structurally functional model of a MIS cell.

Each MIS is characterized by a set of functions fulfilled by blocks, which realize functions and information interchanges. In accordance with solved problems, the structurally functional cell breaks up to three hierarchical levels: functional (analytic-synthetic) – level 1; tactical (analyses-coordination) – level 2; strategic (coordination) – level 3.

The new principle of the computers construction is offered, in which the principle of organization of brainwork simultaneously with a principle of programmed control assumes as a basis. The principle of organization of brainwork assumes as a basis of operation of such computers, in classical element basis it will be for more to Hilbert machines 2 than for nowadays existing Neumann machines, the basis of which is the principle of programmed control realized rather slowly.

FORMALIZATION OF CONSTRUCTION PRINCIPLES OF MANY-VALUED STRUCTURES

Let's illustrate proposed construction approaches of multiple-valued invertible heterogeneous logic elements of the first kind for hardware implementation of a preset finite relation in an arbitrary way.

Let us assume that the binary relation of conjunction is given by

$$g = a \cdot b \quad (1)$$

where $g(a,b) = \min(a,b)$ and a digit number of the variable g is defined on the basis of the relation. Relation on (1) will be examined as a predicate equation connecting variables a , b and g . The given equation is not only a conjunction function (for example, for k -valued conjunction of the multiple-valued logic), but

and the whole number of the distinctive feature for predicate equation of such kind (as distinct from relation of k-valued logic) is their heterogeneity.

Thus, for the given approach feasibility of dependences consideration and analysis in the form of

$$a \cdot g = b (b \cdot g = a)$$

is characteristic, which can be studied on the basis of initial binary relation (1). A possibility to define a value of the variable g depending on values of variables a, b, as well as a value of the variable b depending on values g and a (similarly, as value of the variable a depending on values g and a) comes into being.

On the one hand it improves circuit reliability from the point of view of single simulation of faults [2] when by single constant fault (occurrence of combination non on all buses of one or another decision or output variable) it is possible to localize a place and defect causes, and on the other hand, it is implicit test diagnosing and realize a definition process of technical circuit state as per information on output circuits of known (initial) variables. Similarly, conjunction relations containing more than three variables with a different digit number can be implemented under hardware control (in the form of the switching circuit of the first kind). The last contention in full measure assigns to the disjunction relation.

Thus, we have a definite set of “building blocks” implementing predicate equations in the form:

$$y = a \vee b; y = a \vee b \vee c; y = a \vee b \vee c \vee d$$

etc., where a number of variables $n < 8 \div 10$ in their different number.

Thus, having such set of multiple-valued invertible heterogeneous logic elements (“building blocks”) for removal a limitation on a number of variable in the initial predicate equation in an “increased” digit number of the majority of its variable and we come now on to consideration of a problem of multiple-valued invertible heterogeneous logic elements synthesis of the second kind.

CONCLUSION

On the basis of general principles and methods of universality hybridism and parallelism (speed) of k-valued spatial structures a new class of universal functional converters - switching circuits of the third kind which allows to implement analysis, normalization and synthesis of Ukrainian language morphology problems has been created.

The problem solving of principles formalization of the structure organization of computing tools, thus ensures construction of the newest concept for systems of an artificial intelligence; application of space and temporal parallelism at structural and algorithmic levels; creation of procedural function languages, parallel machines of knowledge bases and the interface. The problem solving of organization principles formalization of universal k-valued structures of a spatial type by tools of predicate and hybrid logic will ensure construction of a modern concept for artificial intelligence systems, application of spatial parallelism at structured and algorithmic levels; creation of functional languages of parallel machines of knowledge basis; application of symbiosis of two- and many-level heterogeneous coding.

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