Space-Time Modeling of Heuristic Problems for Decision-Making Systems

Larisa Glinenko

Abstract - **Mathematical model of heuristic problems satisfying demands to models in ihtellectual systems is developed on basis on space-time structure model of a function.**

Keywords - **Model, heuristic problem, conflict.**

I. INTRODUCTION

Algoritmizacion of heuristic problem solving supposes formalization of their models to a level, providing for their application in the bases of models of intellectual systems (IS). It requires their presentation as logic mathematical models with frame compatible organization. This demand is satisfied for such current models as physical contradiction (FC), subfield and their advanced modifications - Z.Royzen's TOP-model [1] and triade model [2].

However these models do not contain elements, able to provide authentication of method of problem solving. They enable just to outline the most general direction of the problem solving without possibility to specify it as a set of few alternatives, proposed to a decision maker.

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II. STUDY RESULTS

The paper describes a method of heuristic problem modeling based of on the structure model of a function [2, p. 72 – 78] and modern theory of multitudes.

To overcome the shortcomings of existing FP-based models a space-time model of conflict (STM) reflecting the topology of spatial and time relations between domains in which a problem element must take one of two incompatible values is proposed. Localization of these domains allows to systematize the varieties of problems of structural synthesis on the basis of prototype transformation and to select one of the standatized alternatives for every problem solving.

The main elements of the model proposed are the operative space (OS) and operational time (OT). OS can be defined as a space domain of the conflict under consideration consisting in demand of possessing by the problem parameter P_x of a problem element x two incompatible values in order ro realize both of conflict functions F1 and F2, OT – time of this conflict. Obviously OS = SF1∩SF2; OT = TF1∩TF2, where SF1, SF1, TF1, TF2 correspond to space and time zones of functions F1 and F2 respectively. From the structural model of a function represented by its action A, carrier C, object O and conditions CN it is evident that the conflict functions F1 and F2 are to have at least one common element within the OS and OT:

$$A_{F1}\neq A_{F2}\vee O_{F1}\neq O_{F2}\vee C_{F1}\neq C_{F2}\vee CN_{F1}\neq CN_{F2}. \quad (1)$$

In turn, conditions CN include space and time domains of function execution

$$CN_{F1}\neq CN_{F2}\supset(SF1\neq SF2)\vee(TF1\neq TF2)\vee(SF1\neq SF2\wedge TF1\neq TF2);$$

$$CN_{F1}=CN_{F2}\supset SF1=SF2\wedge TF1=TF2. \quad (2)$$

Analizing possible combinations of (1) and (2), we can get the exsaustive list of heuristic problem terms:

$$C_{F1}\leftrightarrow C_{F2}; O_{F1}\neq O_{F2}; \forall A_{F1}; \forall A_{F2}; CN_{F1}\neq CN_{F2}\supset SF1=\neg SF2; TF1=\neg TF2; \quad (3)$$

$$C_{F1}\leftrightarrow C_{F2}; O_{F1}\neq O_{F2}; \forall A_{F1}; \forall A_{F2}; CN_{F1}\neq CN_{F2}\supset SF1=\neg SF2; TF1=TF2; \quad (4)$$

$$C_{F1}\leftrightarrow C_{F2}; O_{F1}\neq O_{F2}; \forall A_{F1}; \forall A_{F2}; CN_{F1}\neq CN_{F2}\supset TF1=\neg TF2; SF1=SF2; \quad (5)$$

$$C_{F1}\leftrightarrow C_{F2}; O_{F1}\neq O_{F2}; CN_{F1}=CN_{F2}; A_{F1}\neq A_{F2}; \quad (6)$$

$$C_{F1}\leftrightarrow C_{F2}; O_{F1}\leftrightarrow O_{F2}; \forall AF1; \forall A_{F2}; CN_{F1}\neq CN_{F2}\supset SF1=\neg SF2; \quad (7)$$

$$O_{kl}\leftrightarrow O_{ij}; C_{F1}\leftrightarrow C_{F2}\vee O_{F1}\leftrightarrow C_{F2}; C_{F1}\leftrightarrow O_{F2}, \forall A_{F1}, A_{F2}; CN_{F1}\neq CN_{F2}\supset TF1=\neg TF2; \quad (8)$$

$$C_{F1}\leftrightarrow C_{F2}; O_{F1}\leftrightarrow O_{F2}; \vee O_{F1}\leftrightarrow C_{F2}; C_{F1}\leftrightarrow O_{F2}, A_{F1}\neq A_{F2}; CN_{F1}=CN_{F2}. \quad (9)$$

As expressions (3÷9) set the variants providing for conflict existence it seems possible to treat them as kinds of the space-time models of the conflict. They can be decomposed to subkinds depending on the terms of divergence realization for SF1 and SF2, TF1 and TF2 – for all domain points, for their part or for all but one.

Such a decomposition is to be carried while creation of IS base of models. After that the STM variants will form library of compatible models of heuristic problems for the further application in the system of computer support of their solving.

III. CONCLUSION

Discussed in this paper kinds of heuristic problem space-time models can be trated as a major premise for creation of base of models for computer-aided decision-making system.

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Larisa Glinenko - Lviv Polytechnic National University , S. Bandery Str., 12, Lviv, 79013, UKRAINE, E-mail:lkg2002@ukr.neta