Multicriterion Problem of the Control of Large Systems under the Limited Resources

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***Abstract*— There has been investigated in the paper a specific problem of scheduling theory with a quality vector index such that the number of processors is not bounded and there has been defined a matrix with bounded elements instead of the weighted vector. For such class of problems a new *P*-hard algorithm has been proposed.**

***Keywords*— optimal schedule; mathematical model; algorithm**

I. INTRODUCTION

A person in his daily activity unwittingly strives to do everything with appropriate-rational manner, e. i. to implement optimization process of solving problem to find the best solution version among possible ones in the considered situation. Many factors must be taken into account in projecting large systems.

The main problem of multicriterion sampling is a detection of preference of people, who make decisions on the set of solution alternative versions [3].

This procedure may be in the definition of no dominating alternatives set – Pareto set, in the simplest case this set consists of one element, the best alternative.

There are well-known approaches to solve problems of multicriterion sampling. The most frequently used method "scalarization" (convolution) is based on the union of all partial specific functionals in the form of weighted sum with weights d_i, $\Sigma d_i = 1$. In addition weight coefficients d_i are considered as an index of relative significance of separate partial functionals. However, in the presence of essentially diversified partial criteria it is enough difficult to determine the set of weighted coefficients d_i.

A mathematical model of the large system creation is considered, which requires different kind of material and financial resources in the work and their amount on the different stages of planning is limited.

The formulated problem is considered as a problem of scheduling theory, in which necessary number of entered system processors to fulfill tasks is infinite, processors are mutually exchanged, partially ordered set is not empty, but the set of additional resources is limited[5]. Purpose of the problem is to construct the best graph of the tasks realization according to all criteria, to satisfy all limitations. It must be taken into account restrictions on the sequence of tasks execution and on the use of additional type of resources.

The formulated problem is NP complicated[4]. On the basis of theoretical results an algorithm is constructed, which is based on the dynamic programming and combined method of branches and boundaries [2].

The main essence of this method means that instead of considering a simultaneously large number of parameters it is possible to sample them by turns.

Thus, multi-dimensional problem of optimization is reduced to the multi-stage and less dimensional problem.

The received algorithm, which gives possibility to construct the best schedule, gives recommendations to the decision making person to mobile control of the system in dialogue condition. To construct the algorithm used Knot Theory and methods of Combinatorial Analysis [1].

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