Modifications of the Algorithm for Selection Isomorphic Subgraphs from Graph

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Abstract – **In this paper considered two modifications of the algorithm for selection isomorphic subgraphs from graph.**

Keywords – **Graph isomorphism, Isomorphic subgraphs, Typification problem.**

I. INTRODUCTION

Selection isomorphic subgraphs from graph is a special case of identification of isomorphic graphs entry. Development of methods and algorithms for solving problems of recognition of isomorphic graphs entry performed for many years and still is relevant. This is due to the fact that this problem is NP-complete, and, consequently, difficult to develop an algorithm that allows you to find the optimal solution within a reasonable time. The emergence of new, more advanced methods, tools and technologies for electronic equipment and increasing the degree of integration of digital and analog circuits is the reason for the development of new algorithms for recognition of isomorphic graphs entry and the solution of typification problem in particular [1].

Practical value of the work on selection in graph isomorphic subgraphs is that solving this problem allows to resolve typification problem and unification for different types of complicated devices and, primarily, for regular structures of digital equipment.

II. ALGORITHM OF SEARCH ISOMORPHIC SUBGRAPHS IN GRAPH

For finding isomorphic subgraphs in graph was proposed algorithm using the method of random-directed search [2]. This algorithm includes following steps:

1. Formation of graph G, adjacency matrix C(G), initial weights of nodes W(V), which divided the whole set of vertices V into classes by the value of W_i.
2. Formation of new classes of nodes pairs according to their value cij and nodes weights, determine their priorities. Formation of subsets of nodes pairs according to their classes.
3. Do subsets of nodes pairs, which do not intersect, exist? If there is not, then move to step 4, otherwise – to step 6.
4. Look through each class according to priority. Maximal number of pair, which do not intersect, are united.
5. Result of each pairs union is new node with new weight. Formation of new nodes and new pairs. Move to step 2.
6. Output and analysis of results. Analysis of the results, in terms of their practical relevance is determined by the specific simulated object graph (scheme, typical architectured design and so on).

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It is believed that if pairs are in one class, their graphs of the original vertices are isomorphic. But the results of testing the developed program has shown that it is not always the case. Thereby, the algorithm should be extended by adding a few checks.

III. MODIFICATIONS OF THE ALGORITHM FOR SELECTION ISOMORPHIC SUBGRAPHS FROM GRAPH

One of the possible ways of finding new graph invariants may be using the method of optimum reducation, which enables to construct invariants for establishing graph isomorphism as a proper of binary graph reduction tree.

Let us consider the applying of the above-descripted algorithm on a simle example. In Fig.1 presents the input graph.

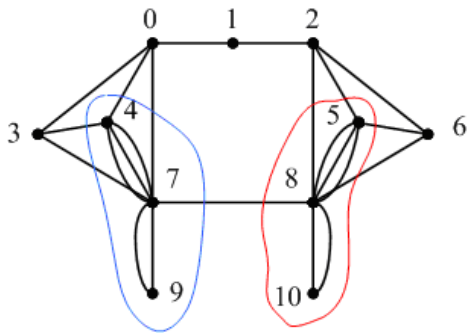

Fig. 1 Input Graph

As a result of the algorithm were formed binary reduction trees, shown in Fig.2.

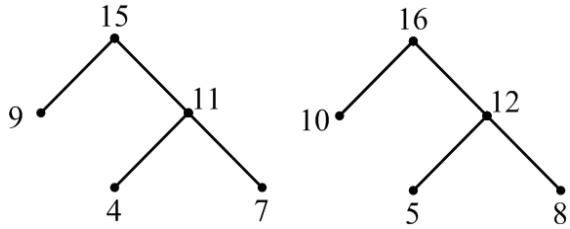

Fig. 2 Binary reduction trees resulting from the algorithm

Thus, received two subgraphs with such nodes: {4, 7, 9, 11} and {5, 8, 10, 12}.

As you can see from figure 1, obtained subgraphs are isomorphic. Also shows that in fact isomorphic subgraphs of the input graph are larger than was found as a result of this algorithm. Consequently, this algorithm requires improvement.

In this connection been proposed and investigated the improvement of the algorithm for selection isomorphic subgraphs in graph based on the optimum reduction method and its modification.

For graph presented in figure 1 proposed algorithms produce results presented in figures 3, 4 and 5.

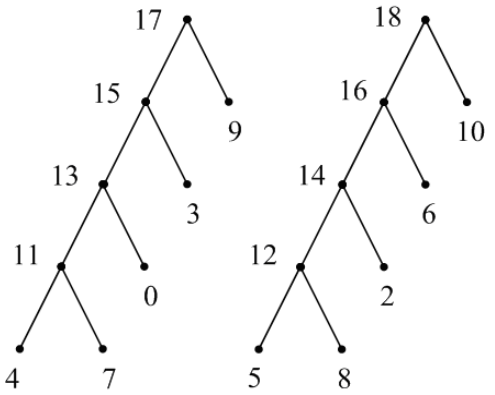

Fig.3 Binary reduction trees, obtained as a result of the improved algorithm

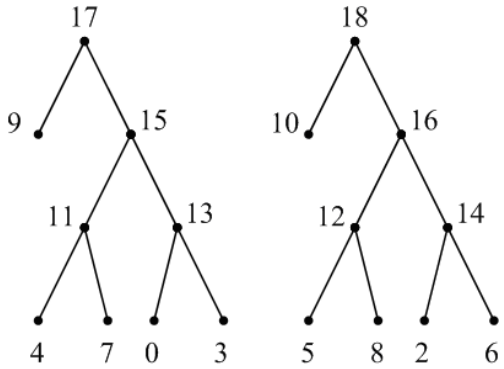

Fig. 4 Binary reduction trees, obtained as a result of the improved algorithm modification

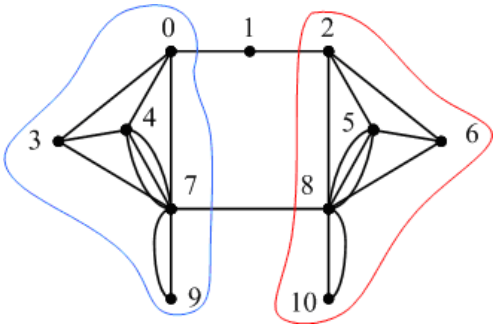

Fig. 5 Obtained subgraphs of the input graph

As you can see from these figures, proposed improvement and its modification give qualitatively better decisions as they select more nodes in isomorphic subgraphs. Proposed improved algorithm is shown on figure 6.

Algorithm modifications testing showed that they are also effective in solving subgraph isomorphism problem on large graphs. Proposed modification of this algorithm simplifies software implementation.

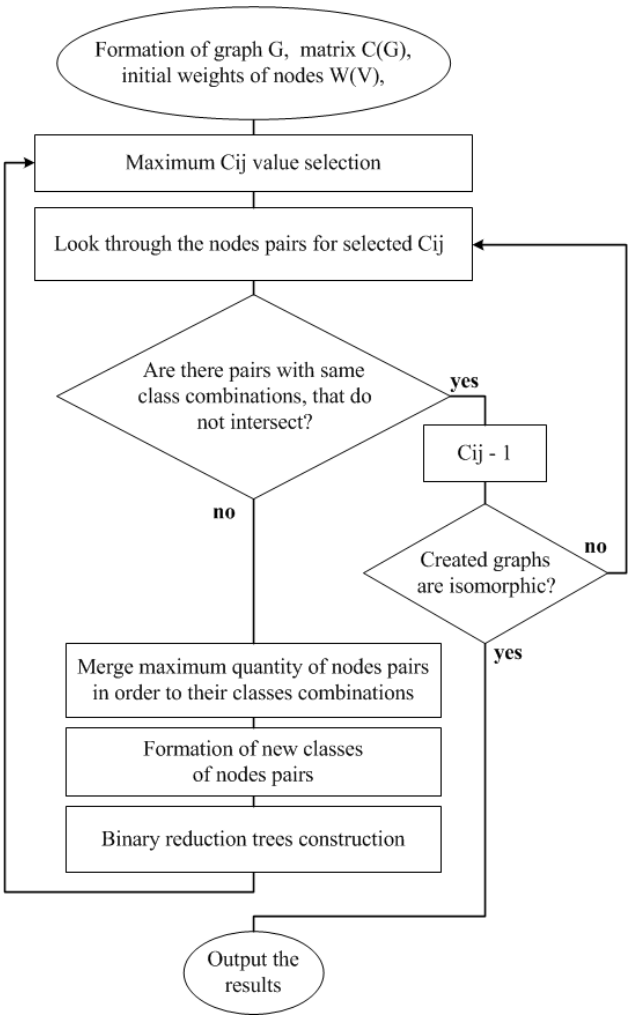

Fig. 6 Improved algorithm for selection isomorphic subgraphs from graph

IV. Conclusion

Compared to known algorithms, proposed modifications allow to improve the results – to simplify software implementation or to get larger isomorphic subgraphs.

Results of solving the problem of selection isomorphic subgraphs from graph can be used for modernization the existing computer-aided design of radio electronic and electronic computer equipment to expand their functionality and increase the quantity and quality of design procedures that are performed automatically.

References

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