**Optimization of Partitioning the Domain into Subdomains According to Given Limitation of Space**

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**ABSTRACT**

The tasks of geometric design (packaging, layout, coating, partitioning) consists in optimizing the display of geometric information about objects in accordance with a given quality criterion and limitations. The geometric information about a geometric object consists of three components: spatial form, metric form parameters that determine their sizes, and spatial placement parameters. The configuration space of geometric objects is based on the formalization of the concept of geometric information. The mapping of many objects onto their configuration space according to a given set of restrictions defines the spatial configuration of geometric objects. The article introduces the concept of the spatial configuration of partitioning a domain into subdomains via which a new model of its partitioning into two types of subdomains is constructed, each of which is divided into subdomains according to different quality criteria and limitations. As an example, the problem of partitioning a three-dimensional domain (building) into two types of subdomains has been solved, the former is the subdomains for the functional purpose (premises) with maximization of their volumes taking into account design standards. The latter is the subdomains that determine a rational network of routes, according to a given criterion, an example of which is the time of complete evacuation of people from a building with constraints on both the flow parameters of the people and the metric characteristics of the routes in view of the design standards. Petri nets are used to calculate the time of movement of homogeneous flows of people, and their sequential individual and flow movement is used for the heterogeneous flows of people. Consideration of metric characteristics and placement parameters of objects as generalized independent variables will allow us to propose new mathematical models and optimization methods for synthesizing spatial configurations in the future and can be used, for example, when partitioning vehicles compartments during cargo transportation and storage in pattern recognition systems, robotics, etc.

**KEY WORDS:**[**geometric object**](http://search.begellhouse.com/index.php?word_search=geometric+object&facet_search=&facet=all&site=dl)**,**[**geometric information**](http://search.begellhouse.com/index.php?word_search=geometric+information&facet_search=&facet=all&site=dl)**,**[**partitioning**](http://search.begellhouse.com/index.php?word_search=partitioning&facet_search=&facet=all&site=dl)**,**[**tracing**](http://search.begellhouse.com/index.php?word_search=tracing&facet_search=&facet=all&site=dl)**,**[**configuration space**](http://search.begellhouse.com/index.php?word_search=configuration+space&facet_search=&facet=all&site=dl)**,**[**generalized variables**](http://search.begellhouse.com/index.php?word_search=generalized+variables&facet_search=&facet=all&site=dl)**,**[**mathematical model**](http://search.begellhouse.com/index.php?word_search=mathematical+model&facet_search=&facet=all&site=dl)**,**[**optimization**](http://search.begellhouse.com/index.php?word_search=optimization&facet_search=&facet=all&site=dl)

**REFERENCES**

1. Stoyan Y.G., Yakovlev S.V., Configuration space of geometric objects, Cybernetics and Systems Analysis, 2018, 54, No. 5, 716-726. .
2. Yakovlev S.V., On some classes of spatial configurations of geometric objects and their formalization, Mezhdunarodnyi nauchno-tekhnicheskiy zhurnal "Problemy upravleniya i informatiki", 2018, No. 5, 73-84. .
3. Stoyan Yu.G., Main problem of geometric design [in Russian], Preprint 181, Institut problem mashinostroyeniya AN UkrSSR, Kharkov, 1983. .
4. Stoyan Yu.G., Placement of geometric objects [in Russian], Naukova dumka, Kiev, 1975. .
5. Stoyan Yu.G., Gil N.I., Methods and algorithms of placing plane geometric objects [in Russian], Naukova dumka, Kiev, 1976. .
6. Stoyan Yu.G., Yakovlev S.V., Mathematical models and optimization methods of geometric design [in Russian], Naukova dumka, Kiev, 1986. .
7. Yakovlev S.V., Gil N.I., Komyak V.M., et. al., Elements of geometric design theory, Ed. by Rvachev V.L. [in Russian], Naukova dumka, Kiev, 1995. .
8. Yakovlev S., Kartashov O., Komyak V., Shekhovtsov S., Sobol O., Yakovleva I., Modeling and simulation of coverage problem in geometric design systems, IEEE 15th International Conference on the Experience of Designing and Application of CAD Systems (CADSM), Polyana, Ukraine, 2019, 20-23. .
9. Kiseleva E.M., Lozovskaya L.I., Timoshenko E.V., Solution of continuous problems of optimal covering with spheres using optimal set-partition theory, Cybernetics and Systems Analysis, 2009, 45, No. 3, 421-437. .
10. Kiseleva E.M., Shor N.Z., Continuous problems of optimal set partition: theory, algorithms, applications [in Russian], Naukova dumka, Kiev, 2005. .
11. Komyak V.V., Models and methods of partitioning and tracing for estimating the routes of evacuation in high rise buildings during design [in Ukrainian], Avtoreferat dyssertats. kand. tekhn. nayk: 01.05.02 "Matematychne modelyuvannya ta obchyslyuvalni metody", KhNURE, Kharkiv, 2014. .
12. Komyak V., Komyak V., Danilin A., A study of ellipse packing in the high-dimensionality problems, Eastern-European Journal of Enterprise Technologies, 2017, 1/4(85), 17-23. .
13. Komyak V., Sobol O., Kartashov O., Yakovleva I., Komyak V., Danilin A., Lyashevskaya O., Computer simulation of the partitioning by mutually orthogonal lines, IEEE 15th International Conference on the Experience of Designing and Application of CAD Systems (CADSM), Polyana, Ukraine, 2019, 16-19. .
14. Timofeeva N.K., On some properties of sets partitioning into subsets, Upravlyayushchie sistemy i mashiny, 2002, No. 5, 6-23.