# THE METHOD OF CONSTRUCTION 0-LEVEL Φ -FUNCTION FOR NOT ORIENTED PLANE GEOMETRIC OBJECTS WITH SECTIONAL NONLINEAR FRONTIERS

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***Summary.*** **In this paper approach to construction 0-level Φ -function for not oriented plane geometric objects with sectional nonlinear frontiers, that allows developing the method of optimum placement such objects in the given areas, is considered.**

***Keywords:*** **0-level Features are undirected facility.**

*Formulation of the problem*. Class optimization problems of geometric design, which includes placement problem, coating, lining and partitioning optimal routes is urgent and has wide application. If we consider the problem of optimal placement of geometric objects, we can conclude that in the space for describing the boundaries of facilities and accommodation areas are used, usually segments and arcs. However, using fragments curves will improve the approximation accuracy and reduce the number of vertices to describe the boundaries of the respective objects affects the complexity of solving problems placement. Thus, there is scientific and applied problems of developing models and methods to optimize the placement of flat geometric objects with piecewise non-linear boundaries. One of the problems that contribute to solving this problem is the problem of optimal placement undirected planar geometric objects with piecewise non-linear boundaries in the specified areas.

*Analysis of recent research*. Models and methods of solving the problems of the class is devoted to optimization design, for example, in [1-3]. Problem optimal placement undirected planar geometric objects with piecewise non-linear boundaries in the specified areas is given in [4]. To formalize restrictions in problems of optimal placement of objects used - functions apparatus [1]. This function allows you to describe the interaction of two geometric objects and, thus, takes a positive value when objects intersect or touch each other; 0 - at the touch of geometric objects; negative values - when crossing facilities. The greatest interest is the case when - function two geometric objects is zero, and the path that describes undirected touch objects will be a 0-sectional surface of -function. It noted that the issue of constructing 0-level -function for flat geometric objects devoted, for example, in [2,5,6]. However, the following approaches have some disadvantages, namely the high complexity and the need for redistribution peaks during rotation undirected objects with piecewise non-linear boundaries.

*The wording of Article purposes*. In this work necessary to develop a method for constructing 0-level -function for undirected planar geometric objects with piecewise non-linear boundaries.

*Main part.* Consider undirected objects $S_i(u_i)$ and $S_j(u_j)$, as shown in Fig. 1.

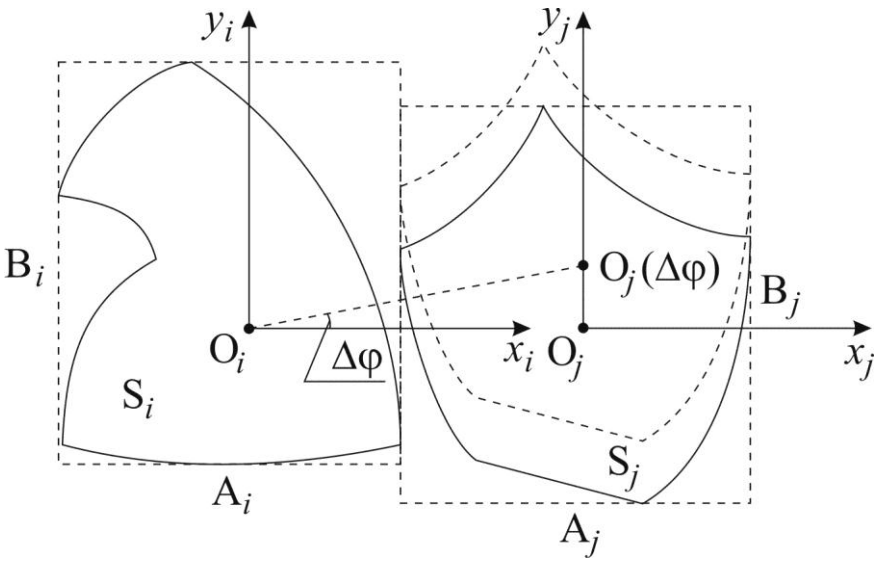


Fig. 1.

These objects are given the coordinates of the vertices in the local coordinate systems, and the top can communicate fragments curves of 2nd order or direct segments. Settings $\{u_i\}=\{x_i, y_i, \theta_i\}$ and $\{u_j\}=\{x_j, y_j, \theta_j\}$ determine the position of objects $S_i(u_i)$ and a global coordinate system and are variable, and $\theta_i$ i $\theta_j$ - angles local coordinate systems.

Fix object $S_i(u_i)$ and build overall rectangles for the data objects with the parties $(A_i, B_i)$ and $(A_j, B_j)$ in accordance. Calculate the angle of interaction of objects $S_i(u_i)$ and $S_j(u_j)$:

$$\varphi = i \cdot \Delta\varphi;\ \Delta\varphi = \frac{2\pi}{n}; \qquad (1)$$

where $i = 0, 1, \ldots, n-1$;

$n$ – sampling options.

Let relevant to the interaction of objects $S_i(u_i)$ and $S_j(u_j)$ carried out as it is shown in Fig. 2. It should be noted that for any first touch provided overall rectangles with sides $(A_i, B_i)$ and $(A_j, B_j)$.

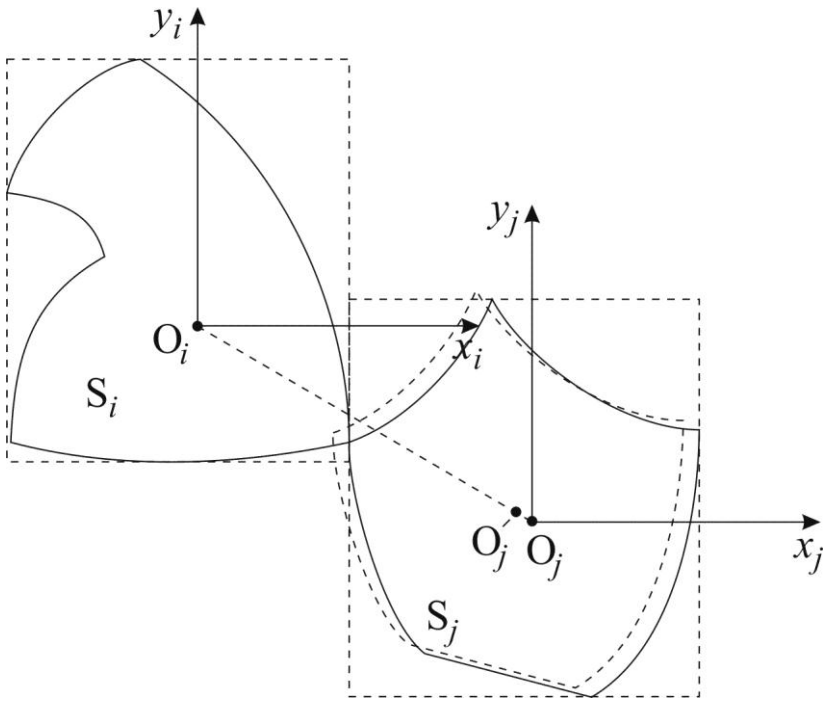


Fig. 2.

Constituents let's move an object $S_j(u_j)$ along the segment $O_iO_j$ on the set value, thus beginning a local coordinate system $x_jO_jy_j$ will be in t. $O_j'$. If this is the intersection of the objects $S_i(u_i)$ and $S_j(u_j)$, t fix it. $O_j$ as one that belongs to the contour of contact data geometric objects (0-sectional surface of -function). Otherwise consider interaction objects $S_i(u_i)$ and $S_j(u_j)$, as shown in Fig. 3.

Compute coordinates $C_i(x_c, y_c)$ and $D_j(x_d, y_d)$ a fixed coordinate system $x_iO_iy_i$ (coordinates find as a result of crossing the segment $O_iO_j$ and the parties geometric objects). Constituents Let's move an object $S_j(u_j)$ along the segment $O_iO_j$ an amount corresponding to the length $C_iD_j$, thus beginning the local coordinate system $x_jO_jy_j$ will be in t.$O_j'$. If the objects $S_i(u_i)$ and $S_j(u_j)$ do not overlap, so fix it.$O_j'$ as one that

belongs to the contour of contact data geometric objects differently - consider the interaction of objects $S_i(u_i)$ and $S_j(u_j)$ as is shown in Fig.4.

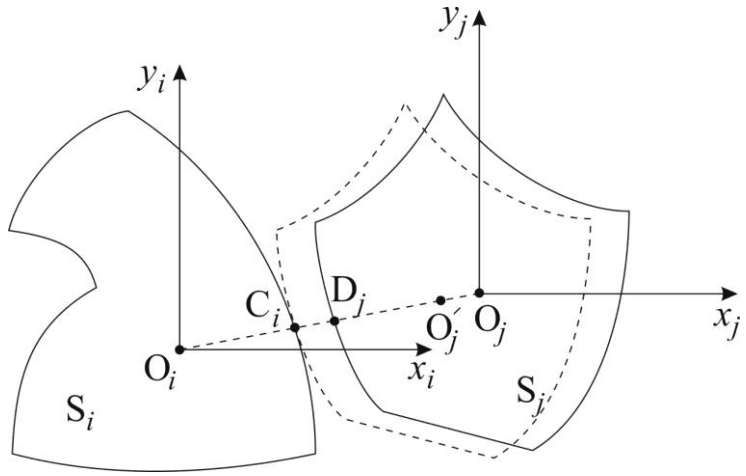


Fig. 3.

In this case, the coordinates t. $O_j^{"}$ contour contact data geometric objects can be produced with a given accuracy by, for example, the method of dichotomy.

So as a result we get a set of points belonging to the contour of contact $\gamma_{ji}$ geometric objects $S_i(u_i)$ and $S_j(u_j)$ (fig. 5, 6).

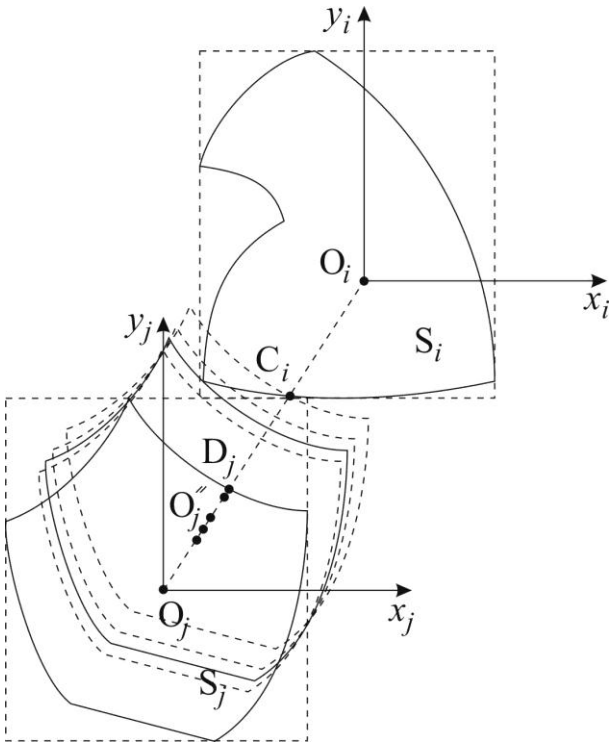


Fig. 4.

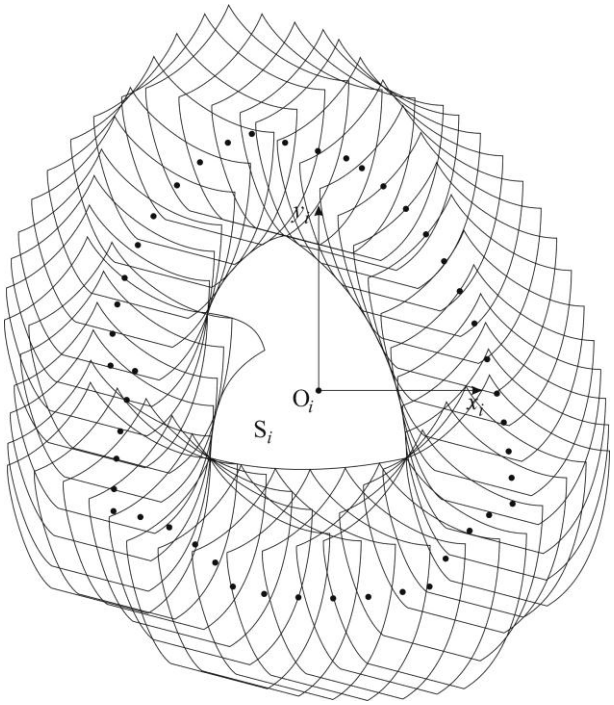


Fig. 5.

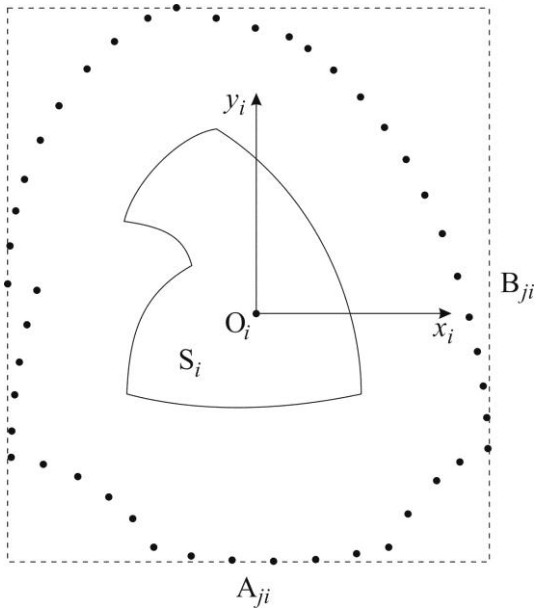


Fig. 6.

For cleaning circuit $\gamma_{ji}$, primarily determined by its initial peak based on the following conditions:

– top border should belong dimensional rectangle with sides $\left(A_{ji}, B_{ji}\right)$ (fig. 6);

– at least one of the adjacent points of the top border does not belong dimensional rectangle with sides $\left(A_{ji}, B_{ji}\right)$.

Further cleaning circuit $\gamma_{ji}$, describing the surface section 0 of -function for objects $S_i\left(u_i\right)$ and $S_j\left(u_j\right)$, by using linear and nonlinear interpolation.

Number of sections that need to build a surface for receiving 0-level -function for undirected objects $S_i\left(u_i\right)$ and $S_j\left(u_j\right)$ with piecewise linear boundaries defined as follows:

$$N_{ij} = k_i \cdot k_j, \tag{2}$$

where $k_i$ – the number of discrete values that can take $\theta_i$;

$k_j$ – the number of discrete values that can take $\theta_j$.

*Conclusions*. In this paper the method of constructing Φ 0-level functions for undirected planar geometric objects with piecewise non-linear boundaries. Further research will be aimed at developing a method of constructing 0-level Φ-functions for these facilities and placing the region and to develop models and methods of optimization undirected placing objects with piecewise non-linear boundaries in the specified areas.

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