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ALGORITHM OF INTERACTIVE ADJUSTMENT OF THE GENERATION OF RATIONAL SCHEMES FOR THE CUTTING OF NATURAL LEATHER ON SHOE DETAILS

Purpose: *Develop an algorithm for interactive adjustment of rational schemes for cutting natural leather for shoe details.*
Keywords: *shoe details, cutting scheme, natural leather, algorithm, software.*

Objectives. Develop algorithms and implement them into software for interactive adjustment of rational schemes for cutting natural leather for shoe parts

Methodology. The research is based on the basic principles of shoe production, methods of mathematical modeling, analytical geometry, theory of algorithms and programming.

Research results. In most cases, the obtained rational cutting schemes can be improved interactively.

The proposed algorithm for interactive adjustment of rational schemes for cutting natural leather for shoe parts has the following functions:

- identification of the necessary detail in the cutting scheme and the possibility of its extraction;
- adding the part selected from the menu to the cutting diagram.

In order to identify the necessary part in the cutting scheme, it is necessary to solve the problem of the relative position of the part and the point. This can be easily done using the ray tracing method [1].

To add the part selected from the menu to the cutting scheme, the following tasks must be solved:

- determining the relative position of the part and the material (the part is outside the boundaries of the material, the part crosses the boundaries of the material, the part is completely on the material and does not cross the boundaries of the material;
- determination of the relative position of two parts (parts intersect, parts do not intersect, and one of them is inside the other, parts do not intersect).
- we will present details and natural leather in the form of polygons.

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Two polygons are said to intersect if any side of one polygon intersects any side of the other polygon. That is, the problem of the relative position of two polygons can be represented as the problem of the relative position of two line segments.

Then two parts will be non-intersecting if no side of one part intersects any side of the other part.

In the case where two details do not intersect, one detail can be inside another detail. This is possible when at least one vertex of one of the two details is inside the other. And this is easy to determine by ray tracing.

We can represent the problem of the intersection of line segments as follows: let us have two segments *AB* and *CD* with the coordinates of the vertices: *A(Xa,Ya), B(Xb,Yb), C(Xc,Yc), A(Xd,Yd).* Then the straight lines that pass through the segments AB and BC will have the form, respectively

$$A_1 x+B_1 y+C_1=0 \quad \text{and} \quad A_2 x+B_2 y+C_2=0$$

where:

$$A_1= Y_b-Y_a; \quad B_1= X_a-X_b; \quad C_1=Y_aX_b-Y_bX_a;$$
$$A_2= Y_d-Y_c; \quad B_1= X_c-X_d; \quad C_1=Y_cX_d-Y_dX_c;$$

A sufficient condition for the intersection of two segments *AB* and *BC* will be that the vertices *A,B* lie on different sides of the straight line *CD* and the vertices *C,D* lie on different sides of the straight line *AB*, i.e.:

$$\begin{cases} (A_1X_c + B_1Y_c + C_1)(A_1X_d + B_1Y_d + C_1) \le 0 \\ (A_2X_a + B_2Y_a + C_2)(A_2X_b + B_2Y_b + C_2) \le 0 \end{cases}$$

The developed algorithms are implemented in software that has a friendly interface and does not require additional knowledge when working with it.

Conclusion. Algorithms have been developed, which are implemented in software for interactive adjustment of rational schemes for cutting natural skins for shoe details.

References

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