CONNECTIONS AND ITS TYPES

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Abstract: This article provides an in-depth analysis of the important connections and their types in the science of graphic representation. The content of connections, analytical and graphic methods of their construction, geometric laws of smooth transitions between straight lines, circles, curves and spatial surfaces are scientifically covered. The practical importance of connections in mechanical engineering, architecture, industrial design and computer graphics is also shown. The article is aimed at forming a drawing culture in students, developing geometric thinking and strengthening the skills of correctly applying connections in real projects.

Keywords: intersection, radius, arc, straight line, circle, spline, graphical method, analytical construction, tangential continuity, geometric smoothness, 3D modeling

In the science of graphic design, it is important to depict geometric shapes accurately, smoothly and in accordance with technological requirements. The quality of the interconnection of elements in the drawing determines not only the aesthetics of the appearance, but also the strength of the details, aerodynamic properties and reliability of constructive solutions. In this regard, joints - a continuous connection of straight lines, arcs and various curves without sharp corners - are one of the basic concepts of graphic design.

With the help of joints, a smooth transition between contour elements in the drawing is ensured, sharp turns are softened, and the degree of geometric continuity is improved. This process also directly affects the functional capabilities of the structure: the stresses accumulated at sharp corners are reduced, the process of manufacturing and mechanical processing of parts is facilitated. Also, the creation of complex shapes in modern computer graphics, mechanical engineering, architecture, and design is simply unimaginable without joints.

Therefore, correctly constructing connections, distinguishing between their different types, and knowing the geometric laws inherent in them are essential theoretical and practical skills for every student studying graphic design.

Connections and their main types

Connections in the practice of drawing and computer graphics is a method of connecting intersecting or adjacent edges of objects in a smooth shape using an arc of a certain radius. With the help of joints, transitions between geometric shapes are smoothed, sharp corners are eliminated, and the drawing is made aesthetically and constructively perfect. In graphics systems such as Autodesk AutoCAD, joints are performed using the FILLET command, which allows you to work with sections, rays, arcs, circles, and polylines.

Bonding process

When creating a joint, the joint radius is initially specified. To do this, after calling the FILLET command, right-click and select the "Radius" item from the menu that opens. After entering the radius value from the keyboard, the two objects to be joined are displayed. The

graphics system analyzes the selected lines and places an arc-shaped joint between them accordingly.

If the lines intersect, the arc is placed at the intersection point between them. Even if the lines do not intersect, the system continues them geometrically and connects them according to the given radius. Due to this feature, connections in AutoCAD are one of the most used drawing operations.

Restrictions on the use of grips

In some cases, a connection may not be formed. These include the following situations:

- if the radius of the provided joint is longer than the section being joined;

- if the distance between the two circles being joined is greater than the radius of the joining arc.

The following special cases may occur in the couplings:

- if the lines to be connected are parallel, they are connected by an arc with a radius equal to half the distance between the parallel lines, regardless of the value given to the connection radius

- if the join radius is set to zero, the intersecting lines will be joined together to form an angle

the Shift key while creating a joint, the intersecting lines will be joined together to form an angle.

If the object selected for connection is a polyline, rectangle, or polygon, and you want to connect all its edges in an arc at once, right-click the polyline section, select it, and then select the polyline object.

Usually, when two intersecting lines are connected with a certain radius, the excess part of the lines is trimmed. If a connection is formed and the continuation of the lines, that is, the part up to the intersection point, needs to be preserved, before displaying the connecting lines, right-click and select the Trim section, and then right-click again and select the No Trim section.

Internal fillet - connects the inner corner between two surfaces or lines in a smooth, arc-shaped form. This type reduces stress concentrations and increases the strength of the part. External fillet or "round" - smooths the outer edge, corner corners with a rounded arc. Gives the product a smooth appearance, ease of use and safety. In CAD/technical drawings, fillets are used to connect straight lines, arcs, polylines or intersections of surfaces with a smooth transition.

Chamfer (corner bevel/cut)

Chamfer is a method of softening corners by cutting them with a straight, angled (usually 45°) cut rather than an arc. Compared to a fillet, a straight cut provides a straight transition between two edges. Chamfers are used to ease assembly, fit parts together, and make turns, rather than to reduce stress.

Mixed, variable radius or combination joints

In some design and modeling situations, a constant radius is not enough - in the corners the radius should be large, in other places it should be small. In such cases, a variable fillet / blend is used. In addition, combined fillets are used: that is, a chamfer on one edge, a fillet on the other edge, or a sequence of several radii. This helps to make complex surfaces flexible and ergonomic

Polyline or polygon joints

If the drawing consists of polylines, polygons, or complex contours, the fillet/chamfer function can be used to apply a smooth or beveled joint to each edge. This is often used in architectural and design drawings, when smoothing lines in 2D drawings or structures.

Fillet - a smooth, curved transition; can be an inner or outer edge.

Chamfer - a flat, angular cut; usually made at a 45° angle.

The choice is determined by the purpose of the structure - whether it is a load-bearing part or a composite part.

Joints are an important element that provides smooth and accurate geometric transitions in the drawing. They increase the strength of the structure, reduce stress concentrations, and provide an aesthetic and ergonomic appearance. Fillet (internal and external), chamfer (angular cut), variable radius and polyline joints - each has its own function and scope. The correct selection and application of these types is not only a factor that makes the drawings high-quality and professional, but also helps to fulfill technical requirements in practical projects.

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