Forming of curvilinear structures based on polyhedrons by the projectivographical method

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The disadvantages of projectivographical drawings (PD) include the fact that with their help it is possible to obtain only piecewise linear forms.

Significantly more extensive sets of shapes can be obtained by moving from strictly rectilinear PD elements to nonlinear ones using various deformations.

To obtain curvilinear forms, one can deform an object defined in an affine Euclidean space using a non-Euclidean space.
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Variants of octahedron curvilinear deformations (calculation and showed in *Wolfram Mathematica*)
Among the huge variety of deformations, we distinguish those that are described by the simplest analytical expressions. Spherical and hyperbolic deformations as applied to each point in space can be obtained as a result of a change in the magnitude of the radius vector of this point (using spherical coordinates). For example, we can use the formula:

\[ r_1 = r_s; \]

where \( s \) is the original radius vector of any point in space, \( s \) is the deformation coefficient, \( r_1 \) is the new radius-vector of the point. If \(|s| > 1\) we obtain a spherical deformation, if \(|s| < 1\) then a hyperbolic one.
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Variants of octahedron curvilineal deformations (calculation and showed in **Wolfram Mathematica**)

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Variants of “5-cube compounds” polyhedron deformations
On this slide show the projectivographical drawings of the compounds of three dodecahedrons.
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compounds of three dodecahedrons (two views)

This slide shows the polyhedron that is the source to this system of planes.
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Hyperbolic deformation of compounds of three dodecahedrons
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Twist-deformations of “3-cube-compound” (along one axe)
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Twist-deformations of “3-cube-compound” (along three axes)
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Bend-deformations of “3-cube-compound”
In future studies, it is necessary to solve the problem of determining the limits of applicability of these transformations that preserve the functionality of the tool for creating in three-dimensional space (in other words, how much these transformations can be distorted so that the distortion of the three-dimensional object still maintains conformity with the two-dimensional drawing).
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References

[10] Mount D 2002 *Computational Geometry* (University of Maryland) and other...
Thank you for attention!

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