Spatial self-interlocking structures: three-dimensional and two-dimensional

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The talk is devoted to the theory of self-interlocking structures and to the recent breakthrough in it:

a) There exist two-dimensional self-interlocking structures in 3-dimensional space;

b) One can construct self-interlocking 2-dimensional structures which are rigid once two polygons are fixed.

The main idea of this construction is the ``decahedron'': collection of ten (stretched) faces of the dodecahedron (without two opposite ones). They were suggested by V.O.Manturov and realised in coordinates by V.O.Manturov and S.Kim

Until recently many constructions of 3-d self-interlocking structures were known; these structures are rigid if we fix all polytopes "along the boundary". The main ideas (truncated cubes, octahedra, dodecahedra) belong to A.Ya-Belov.

The self-interlocking structure theory has many applications to architecture, composite materials, cheramics, armors etc.

The principal novelty by V.O.Manturov is the possibility of constructing these structures of "infinitely thin" polyhedra (polygons).

Surprisingly, the system of self-interlocking cubes was found by A.Ya.Belov only in 2002. It is related, in particular, with the lack of human intuition about 3-space.

In the end of the talk we'll suggest a list of problems, both purely mathematical and those related to applications.