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COMPARATIVE ANALYSIS OF BIONIC AND GEOMETRICAL STRUCTURAL FORMS

Keywords: *structural surfaces, bionics, optimization.*

There is a trend in architecture which is characterized by an exploration of spatial forms in analogy to living organisms. Therefore, the analyses carried out by describing forms from the natural environment using mathematical models are becoming more important, which allow for a more accurate representation of the structures found in nature. In the wildlife world we can observe both asymmetrical structures with one axis of symmetry (lateral area) or structures having many axes of symmetry. Among such structures one can seek effective design forms "adapted" to the prevailing conditions where the shape was optimised depending on the occurring loads.

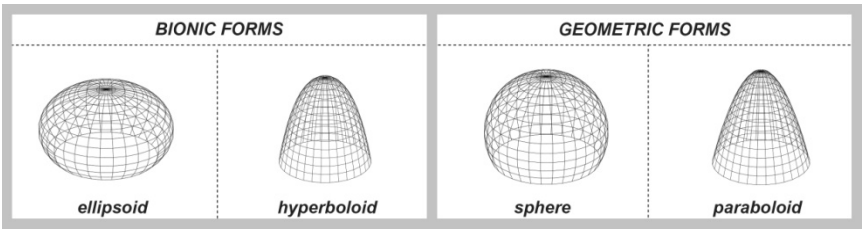

Fig. 1 Examples of bionic and geometric forms used in the analysis.

The article presents the results of studies, which relied on the analysis of structural forms by the adopted homeomorphic assumptions, that correspond to the homological transformation in structures with a common evolutionary origin. The purpose of the analysis in question was to optimize the load-bearing systems based on the example of rod structures. The research applied to the selected symmetrical organic forms and the basic geometric shapes. Catenary curves, among others, were used for the biological form research, while the sphere and the paraboloid were used among the geometric shapes. The basic adopted assumptions are: constant width (base) in relation

to the length of the curve forming a rotating solid and immutable material data. The optimization of rod structures was carried out in view of the minimum weight.