

## MATHEMATICAL MODELING OF ALEATORY MATERIALS IN ARCHITECTURE AND CONSTRUCTION

**Cherkasov T., Ermachenko P., Egorov V.**

Ltd. KB Strelka, Bersenevskaya emb., 6, bld. 3, Moscow, 119072, Russia.  
Phone: +7(926) 989-06-52, E-mail: [nlsystym@gmail.com](mailto:nlsystym@gmail.com)

Platov South-Russian State Polytechnic University (NPI), Prosveshenia str. 132,  
Novocherkassk, 346428, Russia.  
Phone: +7 (988) 992-73-45, E-mail: [neo-ecology@mail.ru](mailto:neo-ecology@mail.ru), Website: [www.neo-ecology.net](http://www.neo-ecology.net)

NPO Strelka Institute, Bersenevskaya emb., 14, bld. 5A, Moscow, 119072, Russia.  
Phone: +7(968) 400-81-02, E-mail: [stainwoortsel@gmail.com](mailto:stainwoortsel@gmail.com)

Since the 70s, in the structural mechanics the algorithms for physical simulation of behavior of granules – DEM (Distinct Element Method) are developed. However, only in recent time the full-scale experiments which confirmed viability of the idea of construction of buildings from elements of the irregular granular shape were made. Thus, research progress was largely caused by the use of seven-axis robot manipulators [1].

Specific feature of use of aleatory granular materials in the architectural field is the difference between them and the traditional uniform geometrically regular construction materials. Absence of restrictions on the form of material is capable to give necessary freedom to a generative algorithm for creation of especially effective constructions with new spatial and esthetic characteristics. Nevertheless, still remain open a number of questions of design of complex architectural shapes.

The basis of DEM-simulation is the method of movable cellular automata. It allows to describe the material environment as a set of granules which interaction leads to evolution of the environment and generation of the form [2]. In our work we try to combine the capabilities of DEM-simulation with generative techniques for efficient architectural structures that can potentially improve the reliability of the integration of biological objects in structural elements of buildings. For example, when creating a comfortable environment for living organisms in vertical gardening systems, or photobioreactors with microalgae [3].

### References

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