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INFORMATION MODELS OF 3D PRINTING FOR BIM SIMULATION OF BUILDING OBJECTS

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Formulation of the problem. Additive manufacturing or three-dimensional (3D) printing at the current stage of its development has turned into a powerful complex of advanced methods and means of automating production processes on a global scale, including construction, construction of building structures from various materials, in particular, concrete.

However, existing models of information data are not fully suitable for the implementation of 3D object printing technology. This is due, first of all, to the lack of information about the relationships between the process, the printing material and the geometry of the digital model of the future construction object.

Also, a significant problem is the lack of appropriate equipment already in the process of creating a prototype before direct printing of the developed model. It is at this stage that it is possible to experimentally check the digital model for redundancy, loss of information and for the correspondence of geometric transformations of the surface of the future building [1].

Purpose of the study. Development of the algorithm of the procedure for creating a virtual 3D printer based on software for simulating robotic construction processes when using 3D printing technology.

Main part. To create a virtual 3D printer, first of all, you need to accept the reference specification of the construction 3D printer and choose the basic software.

CoppeliaSim provides the researcher with a powerful platform for designing and modeling robotic systems. One of the valuable features is the ability to create your own models, which allows you to adapt the software to the simulation process of construction 3D printers [2].

The creation of a virtual model of a 3D printer in CoppeliaSim from 3D files follows a system process that guarantees accuracy, efficiency and a full understanding of the internal processes of the system.

The action algorithm can be divided into several processes (Fig. 1):

Importing the 3D File.

To import the prepared 3D model of the object into the CoppeliaSim environment, the parameters related to the import process are set. It should be noted that the 3D model of the object before this process must already be properly processed and meet its geometric requirements.

Configuring Model Properties.

At the stage of setting model properties, special instructions are developed for setting various properties of the 3D printer model in CoppeliaSim. The physical properties of the 3D printer to ensure interaction with the future environment are determined: accuracy, printing speed, working volume, time, mechanical stability, control system.

Visual appearance, materials and textures are adjusted for realistic reproduction [3].

Defining Model Kinematics.

At this stage, the kinematic definition of the model takes place, connections are created, common properties are determined, and interdependence between objects is established. A representation of the kinematic structure of the 3D printer is formed for accurate modeling.

Conducting Simulations.

This is the most responsible process, during which the BIM model of the construction object itself is transferred to a virtual 3D printer. At this stage, simulation parameters such as time step, duration and other settings [4] are determined and adjusted, simulation scenarios are created and edited. The behavior and performance of the developed 3D printer model, in particular, and the 3D printing process as a whole are tested and evaluated.
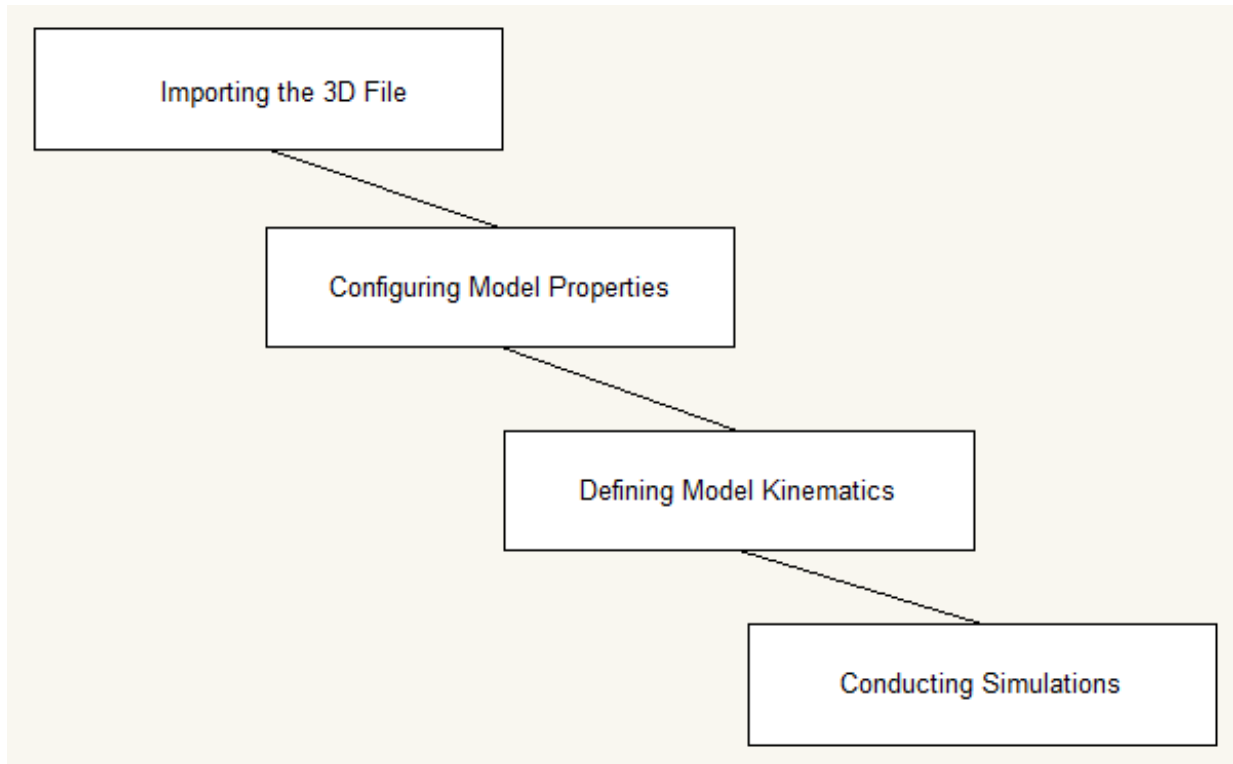
Fig. 1. Stages of creating a virtual model of a 3D printer

Conclusion. The proposed algorithm of the procedure for creating a virtual 3D printer, which allows you to check the BIM model of the construction object for compliance with functional and operational characteristics before the start of the implementation of the construction project. Also, the virtual stand for physical modeling of the processes of 3D printing of construction objects can be used both during scientific research and in the educational process.

References

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