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Simulation of the Design Schemes for Architectural Monuments

Simulation de projets d'études pour des monuments architecturaux

Simulation von Entwurfsmodellen für architektonische Bauten

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The purpose of this paper is to propose of the general ideas on simulation of the historical architectural constructions (destroyed buildings as well) design schemes, also recommendations on their analysis and a more precise definition.

The simulation of the design schemes allows to obtain an obvious situation of the construction stress and deformation state both nowadays and originally. Besides it allows to reveal the reasons of the destruction and to forecast durability and reliability with a definite degree of approximation.

The simulation is implemented in such a sequence:
1. according to the remained part of the construction a space rod design scheme is created as being the most visual one;
2. the geometrical characteristics of the conventional rods are specified so as to bring the work of this design scheme to the work of the real construction as near as possible;
3. the massive parts of the construction are simulated by volume finite elements.

The finite element method and the superelement method are used for the analysis of constructions. It is recommended to use separate parts of the construction as superelements. These parts can be separated out of the construction according to the definite sign and calculated by any method indepedently.

It is proposed to consider the following kinds of superelements:
1. base superelements - the parts of the structure having sufficient strength and degree of stability;
2. unstable superelements - the parts of the structure working under unfavourable conditions, having heavy damages and increased value of the flexibility;
3. cantilivers - various parts of the structure, being in breakdown state, partly destroyed, having different cross sections, representing themselves as handing down parts of structure at different angles. They may be destroyed parts of archs, frames, plates and continuous beams, separately standing columns and other elements.

The cantilivers may be classified and reduced into several types for which research work can be done and recommendations can be

made to determine their carrying capacity.

The analysis of constructions may be performed in two directions: by carring out strength verification of construction parts and by finding out possible reasons of its destruction. While realizing the first direction of analysis besides static calculations great attention is paid to dynamic and seismic calculations. It acquires especial significance if calculated constructions are located in seismic dangerous region such as Mediterranean, Transcaucasus, Middle Asia and other regions.

In the second case analysis is made by defining the possible variants of the foundation settling or by the strength factors application. According to these data theoretical situation of destruction is defined and these results are compared with real situation.

The paper presents analysis of continuous beams, frames and cantilivers with axis in the form of a broken space line,taking into account that geometrical characteristics are changed according to arbitrary law. Stiffness matrixis are determined for these cases.