OPERATION MODELING AND ANALYSIS OF THE STRESS-STRAIN STATE OF DIFFERENT VARIANTS OF TECHNICAL PERFORMANCE OF TIMBER GRID ROOF JOINTS

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From the standpoint of structural mechanics roof grid structures represent statically indefinable rod systems. As a rule, these structures contain a large number of elements and joints. As a result consideration of operation spatiality and joints flexibility are the determining factors in design.

Taking into account all the afore-mentioned factors calculation of grid roofs is advisable to be performed with the use of modern software. At that the calculation of the roof bearing elements grid is sufficient with the use of only rod or shell finite elements, but joints computation requires a more detailed analysis stipulated by the availability of constructive concentrators in the joint units (openings, incisions, slots), as well as elements contact interaction (a nut and a washer, a washer and timber, a bolt and timber, etc.).

In the present research the operation of a timber roof with the orthogonal grid has been analyzed using Solid Works Simulation software package. The roof is formed by a system of interconnected longitudinal and transversal elements made from solid or glued timber. The length of all transversal elements is equal to two sides of the roof cell. Their ends are situated on an arc of the arch and the elements themselves – in the chess order on its surface forming polygonal alternating arches. Longitudinal elements are located on direct lines along the roof and their number is equal to the number of joints in two adjacent arches. The length of longitudinal elements can be varied.

Joint units in the roofs can be of different rigidity: from pin hinge to the braced joint. Consequently, the degree of their flexibility can considerably influence the structure stress-strain condition.

The main goal of the paper is to identify the most loaded roof joint units, to determine their boundary conditions, to suggest some variants of their technical performance, to analyze and compare the operation of suggested joint units and evaluate their flexibility.

The research that has been carried out allows to take decisions as for stress-strain condition of different constructive solutions of the joint units under the same boundary conditions, as well as to evaluate their flexibility.