**V.P. Agapov, A.V. Vasil'ev**

## SOLID MODELS OF RECTANGULAR SECTION COLUMNS WITHIN THE FRAMEWORK OF ANALYSIS OF BUILDING STRUCTURES USING THE METHOD OF FINITE ELEMENTS

The theory of the strength of materials has produced a substantial influence on the development and practical implementation of computer methods of the strength analysis of beams and beam systems. Beams are modeled through the employment of one-dimensional elements within the overwhelming majority of the finite element method software programmes; the stiffness matrix is derived on the basis of the hypothesis of flat sections, and end forces concentrate in the centres of the gravity of cross sections. This approach makes it possible to develop effective algorithms, although it has several drawbacks. They include an incorrect transmission of forces from beams to plates and massive elements of structures, difficulties in taking account of the warping effect of the beam, and the complexity of taking account of physical and geometrical nonlinearities. Some authors suggest using the three-dimensional theory with account for the flat sections hypothesis. It encompasses the patterns of rotations of sections in the analysis of structures, although the problems of warping and shear deformations remain.

The authors propose a new approach to rectangular column modeling by means of the finite element analysis of building structures. Each column is presented as a set of three-dimensional 8-node elements with arbitrary discretization alongside the cross section and the height of the column. The inner nodes of the finite element mesh are excluded sequentially layer by layer, thus, reducing the stiffness matrix and other characteristics of the column with reference to its top and bottom cross sections. The finite element method has been adapted to PRINS software programme. The comparative analysis of the two structures has been completed with the help of this software.

The structures exposed to the structural analysis included slabs and columns. In one case, columns were modeled with the help of one-dimensional elements, and in the another case, the proposed elements were used. The comparison of the results demonstrates that the employment of the proposed elements makes it possible to avoid problems associated with the transmission of the force in a particular point.

**Key words**: building structures, rectangular cross section columns, finite element method, super-elements.

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About the authors: **Agapov Vladimir Pavlovich** — Doctor of Technical Sciences, Professor, **Moscow State University of Civil Engineering (MGSU)**, 26 Yaroslavskoe shosse, Moscow, 129337, Russian Federation; agapovpb@mail.ru; +7 (495) 583-47-52;

**Vasil'ev Aleksey Viktorovich** — design engineer, **Rodnik Limited Liability Company**, 22 Kominterna st., Tver, 170000, Russian Federation; dropt@rambler.ru; +7 (482) 2-761-004.

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