«Features of the design of statically indeterminate frames by the mixed method with rods of a given stiffness»

S A Sazonova, A V Zvyagintseva, S D Nikolenko, E A Chernikov and S S Sumera
Problem statement

- The features of using the mixed method for calculating internal forces in statically indeterminate frames with rods of a given stiffness are considered.
- The substantiation of the choice for the calculation of frames of the mixed method, methods of forces or displacements is given.
- The condition of equivalence of the main and the given systems is provided.
- The calculations took into account the mechanical meaning of the canonical equations and individual terms of the canonical equations of the mixed method.
• The corresponding reactions and displacements are determined. It is substantiated which part of the frame when calculating by the mixed method is more rational to calculate by the method of displacement, and which part by the method of forces.

• Used "tabular" data in the process of calculating the frame by the mixed method. If necessary, frame parts are designed to be statically determinate.

• The features of constructing and controlling the diagram of moments after determining the unknowns, constructing the final diagram of shear forces using the already constructed diagram of bending moments, constructing the final diagram of longitudinal forces using the already constructed diagram of shear forces.
Conclusions

Results, implementation

- The calculation of internal forces by the mixed method in statically indeterminate frames with rods of a given stiffness is carried out. The choice for the calculation of frames is substantiated: the mixed method, methods of forces or displacements.

- The construction of the final diagram of the bending moments and all the necessary calculations and checks is completed. When calculating integrals, Vereshchagin's rule is applied.

- The features of constructing and controlling the diagram of moments after determining the unknowns, constructing the final diagram of shear forces using the already constructed diagram of bending moments, constructing the final diagram of longitudinal forces using the already constructed diagram of shear forces are given.

- The performed calculations make it possible to determine the most dangerous sections of the frame in order to calculate the strength and ensure safety during the operation of building constructions, the design schemes of which correspond to the type of design schemes considered in this article.
Contacts

S A Sazonova¹, A V Zvyagintseva², S D Nikolenko³, E A Chernikov⁴ and S S Sumera⁵

¹Department of Technosphere and Fire Safety, Voronezh State Technical University, 84 October 20th Anniversary Street, Voronezh, 394006, Russia, e-mail: ss-vrn@mail.ru

²Department of Chemistry and Chemical Technology, Voronezh State Technical University, 84 October 20th Anniversary Street, Voronezh, 394006, Russia, e-mail: zvygincevaav@mail.ru

³Department of Technosphere and Fire Safety, Voronezh State Technical University, 84 October 20th Anniversary Street, Voronezh, 394006, Russia, e-mail: nikolenkoppb1@yandex.ru

⁴Department of Industrial Transport, Construction and Geodesy, Voronezh State Forestry University named after G F Morozov, 8 Timiryazev Street, Voronezh, 394087, Russia, e-mail: kafedra_prom_transporta@list.ru

⁵Department of Applied Mathematics and Mechanics, Voronezh State Technical University, 84 October 20th Anniversary Street, Voronezh, 394006, Russia, e-mail: svetlana.sumera@gmail.com