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МОДЕЛИРОВАНИЕ УДАРНЫХ ВОЗДЕЙСТВИЙ НА СТАЛЬНЫЕ РАМЫ ЗДАНИЙ ПРИ ДЕФОРМИРУЕМОМ ОСНОВАНИИ

Аннотация. *Статья посвящена актуальной в настоящее время проблематике оценки живучести стальных рамных конструктивных систем на деформируемом основании в условиях случайных ударных воздействий. Для таких воздействий заранее не определены точка приложения, направление и интенсивность. Полагается, что для существующего проектного решения возникновение таких воздействий не должно приводить к прогрессирующему обрушению. Выполнен ряд расчетов в квазистатической постановке для выявления наиболее опасных случайных воздействий, а затем произведен проверочный расчет в динамической постановке. Расчет в квазистатической постановке выполняется на основе моделей деформационной теории пластичности, а расчет в динамической постановке с учетом ассоциированного закона течения стали. Ударная нагрузка представляется в виде импульса силы, статически эквивалентной динамическому воздействию от неупругого удара жестким телом по конструктивной системе. Предложенные процедуры позволяют проектировать стальные рамные конструкции, устойчивые к случайным аварийным ударным воздействиям.*

Ключевые слова: *риск аварии, численное моделирование, стальные рамы, колонны, конечно элементный анализ, динамическое догружение, ударное воздействие, импульс, безопасность.*

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MODELING OF IMPACTS ON STEEL FRAMES OF BUILDINGS ON A DEFORMABLE SOIL BASE

Abstract. *The article focuses on the currently relevant problem of assessing the safety of steel frame systems on a deformable soil base under accidental impacts. The article considers a case when impact actions can be random, i.e., such parameters as application point, direction and intensity of impact are not determined preliminarily. It is supposed that for the existing design solution the occurrence of such impacts should not lead to progressive collapse, and the structure as a whole should have the property of robustness. In order to estimate this property, it is suggested to carry out a number of calculations for the stress-strain state under the most dangerous random loads and then to carry out a verification analysis in the dynamic statement. For the steel frame, a search problem is solved according to the criterion of minimization of integral safety margin of structural elements. The calculations account for the possibility to prevent the frame buckling. The quasi-static analysis is performed on the basis of the models of the deformation theory of plasticity, and the dynamic analysis is done with regard to the associated law of steel yielding. The proposed procedures allow designing steel frame structures which are resistant to random accidental loads. A shock load is represented in the form of a force impulse which is statically equivalent to the dynamic effect of an inelastic impact of a rigid body on a structural system. An example of design and performance evaluation of a steel frame structure of a two-story building is considered.*

Keywords: *accident risk, numerical simulation, steel frames, columns, finite element analysis, dynamic loading, impact, impulse, safety*.

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