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Achievements of Truss Models for Reinforced Concrete Structures

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ABSTRACT

Achievements are presented for truss models of RC structures developed in previous years: 1. Two constitutive models, biaxial and triaxial, are based on regular trusses, with bars obeying nonlinear uniaxial σ-ε laws of material under simulation; both models have been compared with test results and show a dependence of Poisson ratio on curvature of σ-ε law. 2. A truss finite element has been used in the nonlinear static and dynamic analysis of plane RC frames; it has been compared with test results and describes, in a simple way, the formation of plastic hinges. 3. Thanks to the very simple geometry of a truss, the equilibrium equations can be easily written and the stiffness matrix can be easily updated, both with respect to the deformed truss, within each step of a static incremental loading or within each time step of a dynamic analysis, so that to take into account geometric nonlinearities. So the confinement of a RC column is interpreted as a structural stability effect of concrete. And a significant role of the transverse reinforcement is revealed, that of preventing, by its close spacing and sufficient amount, the buckling of inner longitudinal concrete struts, which would lead to a global instability of the RC column. 4. The proposed truss model is statically indeterminate, so it exhibits some features, which are not met by the "strut-and-tie" model.

KEYWORDS

Reinforced Concrete Structure; Truss Model; Constitutive Law; Material and Geometric Nonlinearities; Concrete Cracking; Reinforcement Yield; Concrete Ultimate Compressive Strength; Plastic Hinge; RC Column Confinement; Buckling of Inner Concrete Struts; Global Instability

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