Recent Advancements in Software Modelling of Infills in Frame Structures

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Abstract:

In recent years, finite element software has significantly expanded its capabilities in simulating the nonlinear response of masonry-infilled frame structures, supporting the transition from simplified macro-models towards more advanced continuum-based representations within standard modelling environments.

Along this evolution line, this study compares two modelling strategies for masonry infills: the classical equivalent diagonal strut, within the context of macro-models, and a nonlinear shell-based formulation, representative of continuum computational approaches. The latter employs layered shell elements to explicitly model the infill geometry and its interaction with surrounding beams and columns in frame skeletons. The constitutive law is defined through a trilinear stress–strain relationship combined with a concrete-type hysteretic model, which allows to reach a more detailed simulation of stiffness degradation and energy dissipation under cyclic loading, as compared to the equivalent strut model, also based on trilinear constitutive law, in this case expressed in terms of force-displacement integral response parameters.

A comparative time-history dynamic assessment analysis is performed on six representative infill types, evaluating the maximum drift demand and hysteretic response for the two models.

The results show that recent developments in commercial finite element codes enable advanced nonlinear modelling of masonry infills without requiring dedicated researchoriented software. This offers a practical balance between computational efficiency and modelling accuracy, enhancing the applicability of continuum-based approaches in engineering practice.

Keywords:

Finite element software, Masonry infilled frames, Equivalent strut macromodels, Shell-based continuum models, Nonlinear time-history analysis.