Use Of Finite Elements In Masonry Structures

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Abstract*:

In the past, the design of masonry structures has been mainly based on empirical codes and specifications validated or accumulated by simple analytical and experimental findings and by practical experience. Masonry has traditionally been considered a low-technology material thus simple assumptions were accepted, making more rigorous constitutive laws and methods of analysis seem unwarranted and nonobligatory. In reality, masonry structures are very complex and are composed of composite materials whose response to loads is highly difficult to predict. Today, more rational approaches are not only becoming more efficient but also indispensable. This refinement is the result of rapid advances in numerical methods, specifically the finite-element method, and in its application to engineering problems. These numerical techniques make it possible to solve complex geometric problems with difficult boundary conditions and strenuous loading cases. An added advantage of numerical methods is cost effectiveness and quick solutions compared to experimental alternatives. The true success of numerical techniques, however, is heavily dependent on a well-validated constitutive model for the material used. These constitutive laws for masonry must be developed on the basis of well-known principles of mechanics and must be thoroughly validated by experimental data. Ultimately, the proliferation of personal computers and engineering workstations makes it possible for small structural engineering firms to use the finite-element technique to analyze complex masonry structures.

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