A macro-element model for inelastic building análisis

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Abstract

A three-dimensional model for approximate inelastic analysis of buildings is presented herein. The model is based on a single macro-element per building storey. The inelastic properties of the model are characterized by the so-called ultimate storey shear and torque (USST) surfaces. Different algorithms for the construction of these surfaces, as well as their applications in building modelling, are presented and discussed. Two alternative procedures are developed to integrate the force-deformation constitutive relationship of the macroelements. The first one follows the exact trajectory of the load path of the structure on the USST, and the second uses linear programming without ever forming the USST surface. The accuracy of the model and integration procedure is evaluated by means of the earthquake response of single-storey systems. The model and integration procedure developed is finally used to compute the inelastic response of a seven-storey R/C building. The results of this investigation show that the model proposed, although approximate, can be effective in estimating the inelastic deformation demand of a building. It also enables the engineer to capture and interpret important features of the three-dimensional inelastic response of a structure even before performing any inelastic dynamic analysis.