Abstract
A multi-level displacement-based seismic design procedure applicable to reinforced concrete frame structures is presented. This procedure simultaneously satisfies the stiffness requirements for the serviceability limit state, of strength for an auxiliary limit state, called of incipient yielding, besides the inelastic deformation capacity for the collapse prevention limit state. The procedure is based on basic concepts of structural dynamics and uses modal spectral analyses, so that it can be executed with commercial structural analysis software used in routine structural design. It is shown that this procedure is capable of predicting the inelastic deformation demands in a simpler and more effective way than other displacement-based procedures. To illustrate and validate the procedure, three reinforced concrete frames structures are designed, and target performance indices are compared with those obtained from inelastic step by step analyses under the design seismic actions. It is shown that the proposed procedure yields maximum demands of inelastic lateral deformations reasonably close to those established for the design.

Keywords
Multi-level design; displacement-based seismic design; higher mode effects.