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Application of the Method of Means to the Stability Analysis of Unbraced Frames

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In design of structures that include slender compression members, it is necessary to consider stability and second order load effects. For unbraced frames, design codes generally allow such evaluations to be based on approximate storey-based approaches. Such methods normally reflect the horizontal interaction between the columns of a storey quite well, and also the vertical interaction between storeys, provided the columns exhibit inflection points in the vicinity of their midheights. When this is not the case, such as in the lower storey(s) of multistory frames with stiff columns and flexible beams, for which the first inflection point above the base may be located near the top of the bottom storey or several storeys up, the predictions of critical loads by isolated column considerations or standard storey-based approaches may become quite inaccurate.

Approximate methods for determination of critical loads and effective lengths of compression members in frame systems are reviewed, discussed and applied to selected unbraced low-rise and high-rise multistorey frames. The methods make use of effective lengths from isolated column analyses to arrive at improved values. They satisfy general system instability principles, are rather simple, and yield in general effective length predictions in good agreement with exact results for a wide variation of parameters. Main emphasis is on a method previously presented and denoted the method of means. Extensions of the method pertinent to unbraced multistorey frames are presented.

KEYWORDS

Analysis, structures, stability, buckling, columns, compression members, effective length, critical load, frames, storeys.