



Comparative Study of Fibre-Based Frame Elements to Analyse Shear-critical RC Frames

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Abstract

Failures due to inadequate shear critical section design have been observed during many seismic excitations. The commonly used one-dimensional distributed-plasticity fibre frame element usually neglects the shear deformation. Although many researchers have tried to develop a shear-flexure model for beam, a simple and realistic shear critical model is yet under the process of development. Its implementation poses many difficulties, which lead to erroneous predictions. The paper discusses some of the issues in implementing a force-based fibre frame element within a shear beam theory. In the present study, a comparison between two commonly used approaches to consider shear in fibre frame elements is presented. The first approach uses an independent shear force-strain relation at the section level, which is the equivalent of considering a shear spring along the member. The second approach considers normal and shear stress coupling at the fibre level using a rotating smeared-crack constitutive relation for concrete material. The effectiveness of both the approach is assessed by simulating the response of two column specimens failed in flexure-shear and shear mode from the literature. The columns are also modelled using the common force-based fibre element based on the Euler-Bernoulli beam theory for comparison purposes. The result indicates that both approach gives a better prediction than the conventional element. However, the first approach is highly dependent on the adopted shear relation. Whereas the second approach, although complex, can simulate the overall experimental behaviour more closely than the commonly used element.

Keywords: Fibre based frame element, RC, Shear failure