A regularized fiber element model for reinforced concrete shear walls

Vásquez, J. A., de la Llera, J. C., & Hube, M. A. (2016). A regularized fiber element model for reinforced concrete shear walls. Earthquake Engineering & Structural Dynamics, 45(13), 2063-2083. <10.1002/eqe.2731> Accessed 26 Nov 2020.

Abstract

Reinforced concrete shear walls are used because they provide high lateral stiffness and resistance to extreme seismic loads. However, with the increase in building height, these walls have become slenderer and hence responsible of carrying larger axial and shear loads. Because 2D/3D finite element inelastic models for walls are still complex and computationally demanding, simplified but accurate and efficient fiber element models are necessary to quickly assess the expected seismic performance of these buildings. A classic fiber element model is modified herein to produce objective results under particular loading conditions of the walls, that is, high axial loads, low axial loads, and nearly constant bending moment. To make it more widely applicable, a shear model based on the modified compression field theory was added to this fiber element. Consequently, this paper shows the formulation of the proposed element and its validation with different experimental results of cyclic tests reported in the literature. It was found that in order to get objective responses in the element, the regularization techniques based on fracture energy had to be modified, and nonlinearities because of buckling and fracture of steel bars, concrete crushing, and strain penetration effects were needed to replicate the experimental cyclic behavior. Thus, even under the assumption of plane sections, which makes the element simple and computationally efficient, the proposed element was able to reproduce the experimental data, and therefore, it can be used to estimate the seismic performance of walls in reinforced concrete buildings..