Characterizing a Reinforced Concrete Beam-Column Connection for Progressive Collapse Assessment

Introduction
Advanced numerical tools are seldom used for progressive collapse analysis of reinforced concrete (RC) structures because it is computationally too expensive and time consuming.

Objective
To develop a simplified structural finite element (FE) model representing a beam-column connection under monotonic loading. This simplified FE model can be used in frame analysis for fast and accurate progressive collapse assessment of RC structures.

Research Methodology
Connection to be Modeled

Predominantly Continuum Based FE Model
- Concrete Damaged Plasticity Model and C3D8R continuum element to represent concrete
- Classical Metal Plasticity Model and B31 beam elements for reinforcement

Validation of Abaqus/Standard:
The following three types of RC beam-column connections were considered:

Corner Connection (Nilson 1973, Test U25)

T-Connection (Nilson 1973, Test T16)

Interior Connection (Nilson 1973, Test U69)

Conclusions
- Three different RC beam-column connections were validated using Abaqus/Standard
- A simplified structural based FE model was developed to replace the predominantly continuum based FE model. The final model retained the accuracy of the continuum based model at a fraction of the computational cost.