Failure analysis of reinforced concrete structure members using PDS-FEM

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Collapse simulation is a key analysis in evaluating the seismic performance of reinforced concrete structures, and analysis of multiple cracking which takes in concrete is a bottleneck of this simulation. The authors seek to develop a new method for this analysis, which takes advantage of particle discretization scheme (PDS). It is easy to implement PDS into FEM, and the resulting PDS-FEM is readily able to determine complicated crack surfaces without introducing new degree-of-freedom. Implementing also the non-linear constitutive relation of concrete, the authors study the applicability of PDS-FEM for the failure analysis of reinforced concrete structure members. Presented are two examples of PDS-FEM analysis, namely, a shear connector and a connector of steel segment. It is shown that the processes of initiation and propagation of multiple cracking are computed by PDS-FEM, and that the cracking pattern is in agreement with the experimental observations.