

## Three-Dimensional Nonlinear Finite Element Analysis of Composite Beam under Cyclic Loads

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Modeling method and numerical simulation approach are presented for an FE-analysis of a composite beam of a steel building frame. We use E-Simulator which is under development at E-Defense of NIED to simulate the seismic collapse behavior of civil structures. The steel beam and column as well as the RC-slab are discretized into linear hexahedral elements. Rigid beams are used for the stud bolts. A piecewise linear mixed isotropic-kinematic hardening law with heuristic and implicit rules are employed for steel materials. The Drucker-Prager model is employed for concrete materials. A detailed analysis is carried out for a composite beam subjected to static cyclic displacement at the end of the beam. It is demonstrated that asymmetric behaviors of the composite beam due to contact between the slab and the column and local buckling at the flanges can be simulated and that the computational results have good agreement with the experimental results.

**Keywords:** Finite element analysis, Steel frame, Composite beam, Cyclic load, Elastoplastic response