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Novel method for simulation of structural post buckling RACHMADIAN WULANDANA, Dept. of Mechanical Engineering and Materials Science, University of Pittsburgh, Pittsburgh, PA, SACHIN VELANKAR, Dept. of Chemical and Petroleum Engineering, University of Pittsburgh, Pittsburgh, PA — A new FEM-based method for simulating the onset of buckling instabilities and the post-buckling evolution is developed. The method consists of creating a random spatial perturbation of the elastic modulus and applying a step-by-step loading to approach the critical state and beyond. Prior to buckling, the non-uniform modulus triggers micro bending and lateral deformation. As the compressive load progresses, the micro displacement grows non-linearly causing the system to be biased toward the mode that minimizes energy. The system buckles in that mode and the post-buckling deformation can be examined. The technique has been applied to several buckling cases. The results show quantitative agreement with theory and experiments. For problems with continuously-distributed buckling modes and critical values that are close from one to another, the method is able to automatically select the correct critical configuration. Unlike other perturbation methods that are inspired by either Eigen vectors or experimental data, the current method does not need a priori knowledge of the expected buckling mode. This is especially useful in complex problems (e.g. wrinkling of stretched films) for which linear eigenvalue analysis cannot predict the critical conditions.

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