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Abstract An anisotropic nonlinear cohesive model based on continuum damage mechanics is proposed to predict the mixed-mode delamination initiation and growth of composite laminates numerically. A damaged exponential traction-displacement jump relationship is proposed for the cohesive model and an exponential damage evolution law on the evolvement of displacement jump is proposed to describe the irreversible delamination crack propagation. The implementation of cohesive model uses zero-thickness cohesive element and middle-plane isoparametric interpolation technique. The mesh size effect is solved by regulating the delamination fracture toughness by the cohesive length, and the numerical convergence problem for the snap instability is addressed by viscous regularization. Four representative delamination cases of composite laminates are used to validate the proposed cohesive model: (a) double cantilever beam (Mode-I), (b) end notch flexure (Mode-II), (c) mixed-mode bending fracture, and (d) fixed ratio mixed mode. The effects of the cohesive strengths and mesh sizes on the global load-displacement response for four cases are studied. In addition, the numerical results using proposed cohesive model are also compared with the results obtained by the virtual crack closure technique and other existing