Phase-field Formulation of Brittle Damage With Application on Laminated Glass Beams

Jaroslav Schmidt
Czech Technical University in Prague, Faculty of Civil Engineering
jarasit@gmail.com

Abstract

Brittle fracture of laminated glass, seen as a layered composite material consisting of glass panes and polymer interlayers, is investigated in this paper. In recent years this sandwich material became popular in civil engineering and is increasingly used in load-bearing elements such as staircases, columns, and floor systems. The phase-field formulation of brittle fracture is employed because of its ability to predict the crack initialization and propagation. As conventional in continuum damage mechanics, a damage field s is defined along the centerline in each brittle layer. For the common cases it is sufficient to assume that the polymer interlayers do not suffer from damage and the damage field s takes place only in the glass layers. Due to the contact stress between glass fragments in post-breakable stage, we implement the anisotropic version of phase-field formulation. It assumes that the damage field s affects only tension, meanwhile in compression the material is intact. Several numerical simulations and comparison between small-strain and large deflection Von Kármán formulation are presented to show the usability of the phase-field formulation of damage for laminated glass beams.

References

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