Abstract

Dynamics of Damage in Two-Dimensional Structures with Waiting Elements

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We consider the dynamics of the damage of a bridge-like 2-D structure made from specially constructed waiting elements. Each element consists of two elastic links of different equilibrium lengths. Whenever the elongation of the shorter link accedes some critical value, it undergoes an irreversible damage process which eventually leads to the breakage. Thereafter the second (longer) link assumes the stress.

Let α be a portion of material used for the first link and $1-\alpha$ be a portion of material used for the second link. We compare the waiting element model with the usual structure, consisting of only one link (of shorter length). In the waiting element model the usual structure corresponds to $\alpha = 1$. By performing various numerical experiments when the structure is impacted by a projectile modeled as an "elastic ball," we show that in some cases the waiting element structure can spread the damage over a large area and therefore withstand larger stresses than the usual structure. Several movies will be shown to illustrate this phenomenon. We also address the question of the optimum choice of parameter α.

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