

Dynamic Buckling of Impulsively loaded I Cores with Imperfections

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Abstract

When sandwich panels with prismatic cores are impulsively loaded, the stresses imposed by the core on the front face, as well as those transmitted through the core, govern the response metrics: especially the center displacement, the resistance to tearing and the loads transmitted to the supports. This article presents a basic study of the dynamic response with emphasis on the influence of manufacturing imperfections in the core members on the formation and propagation of the buckles. A second goal is to examine the stresses associated with the dynamic compression of the core. The investigation is conducted for stainless steel I-core panels supported at the back-face and subjected to a constant velocity at the front. Imperfections to be included in the numerical study have been ascertained by comparing buckle patterns with those found experimentally over the relevant velocity range. Results showed that all imperfections have a dramatic influence on the stress (Figure 1), so that calculations without imperfections are inadequate. The simulations reveal that the stresses induced differ on the front and back faces. On the front they are higher and velocity dependent. On the rear they are velocity invariant and scale with the relative density and material yield strength. The duration of the stress pulses scales linearly with the core height. It correlates with the time needed for buckle-waves to propagate through the core to the back face.

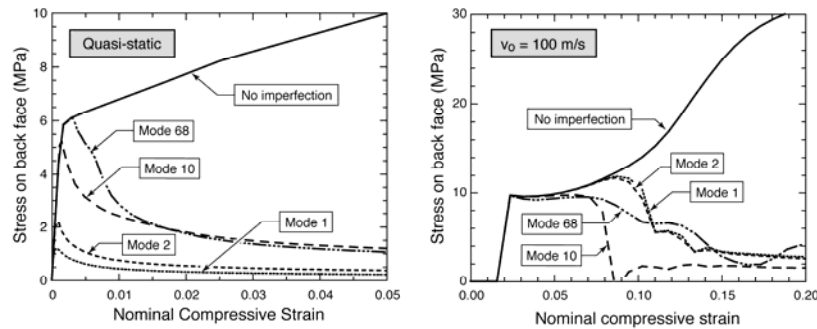


Figure 1, Effects of imperfection mode on quasi-static and dynamic response.