LENGTHWISE FRACTURE ANALYSIS OF INHOMOGENEOUS FRAMES AT NON-LINEAR CREEP

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The present paper analyses the lengthwise fracture of a continuously inhomogeneous portal frame in terms of time-dependent strain energy release rate (SERR). The frame is subjected to non-linear creep. The material of the frame exhibits inhomogeneity in both thickness and width directions of the cross-section. By considering the balance of the energy, a solution of the SERR is derived assuming that the material properties involved in the non-linear stress-strain-time relationship vary continuously along the width and the thickness of the frame cross-section. A solution of the SERR is derived also by considering the complementary strain energy for verification. The solution is applied to evaluate the variation of the SERR with the time. The effects of material inhomogeneity in the width and the thickness directions on the SERR are investigated. A time-dependent solution of the SERR is derived also for the case when a notch is introduced in the inner crack arm. Various graphs are used for showing the results obtained.

Fig. 1. Geometry and loading of inhomogeneous portal frame with a lengthwise crack.

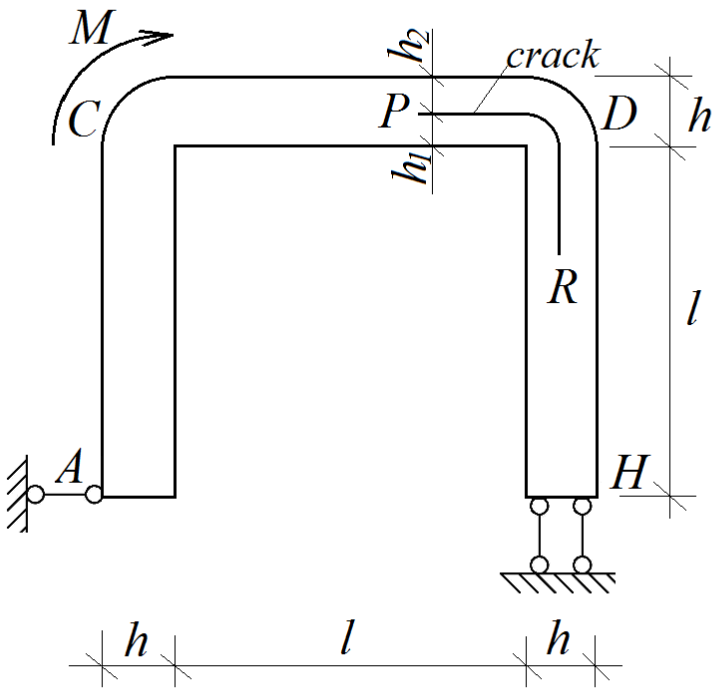

Fig. 2. Cross-section of the horizontal bar of the frame.

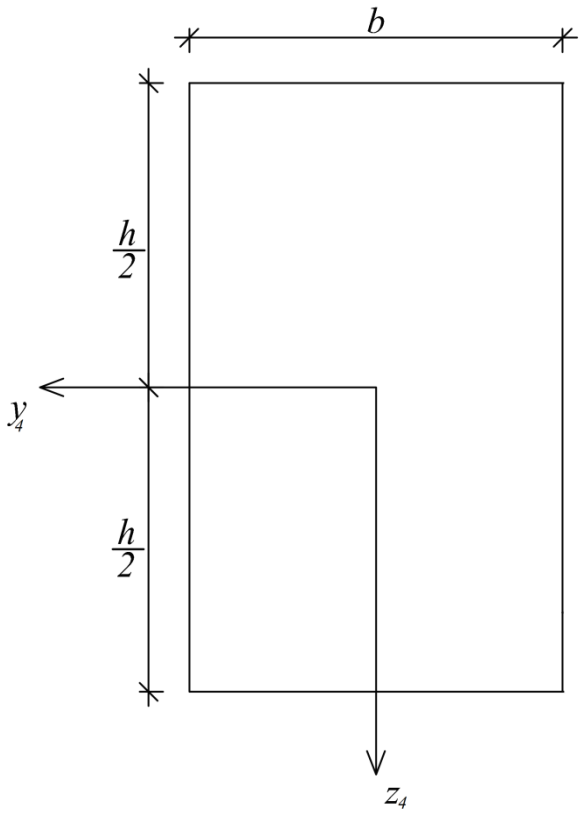

Fig. 3. The strain energy release rate in non-dimensional form presented in a function of the non-dimensional time (curve 1 - at Ed/El=0.5, curve 2 - at Ed/El=1.0 and curve 3 - at ed/El=2.0).

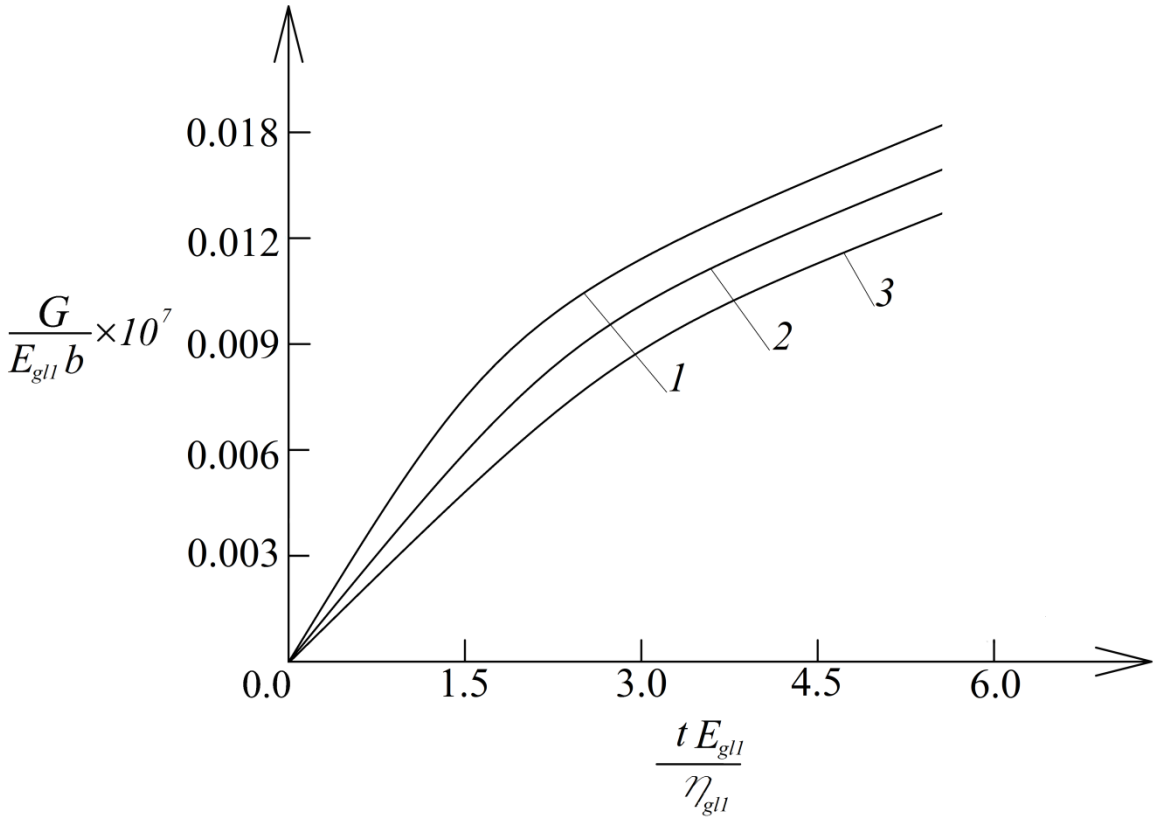

Fig. 4. The strain energy release rate in non-dimensional form presented in a function of h1/h ratio (curve 1 - at Eg/El=0.5, curve 2 - at Eg/El=1.0 and curve 3 - at Eg/El=2.0).

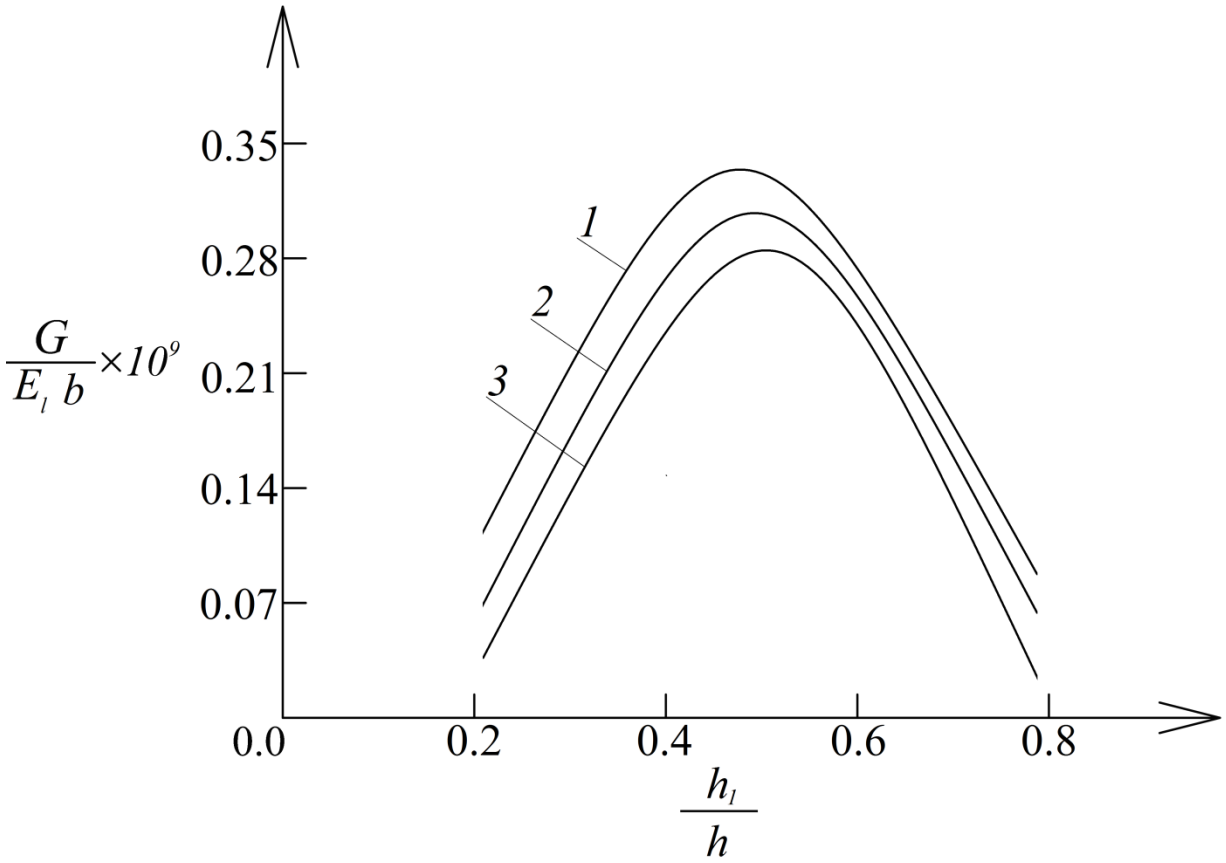

Fig. 5. The strain energy release rate in non-dimensional form presented in a function B1d/B1l ratio (curve 1 - at B1g/B1l=.05, curve 2 - at B1g/B1l=1.0 and curve 3 - at B1g/B1l=2.0).

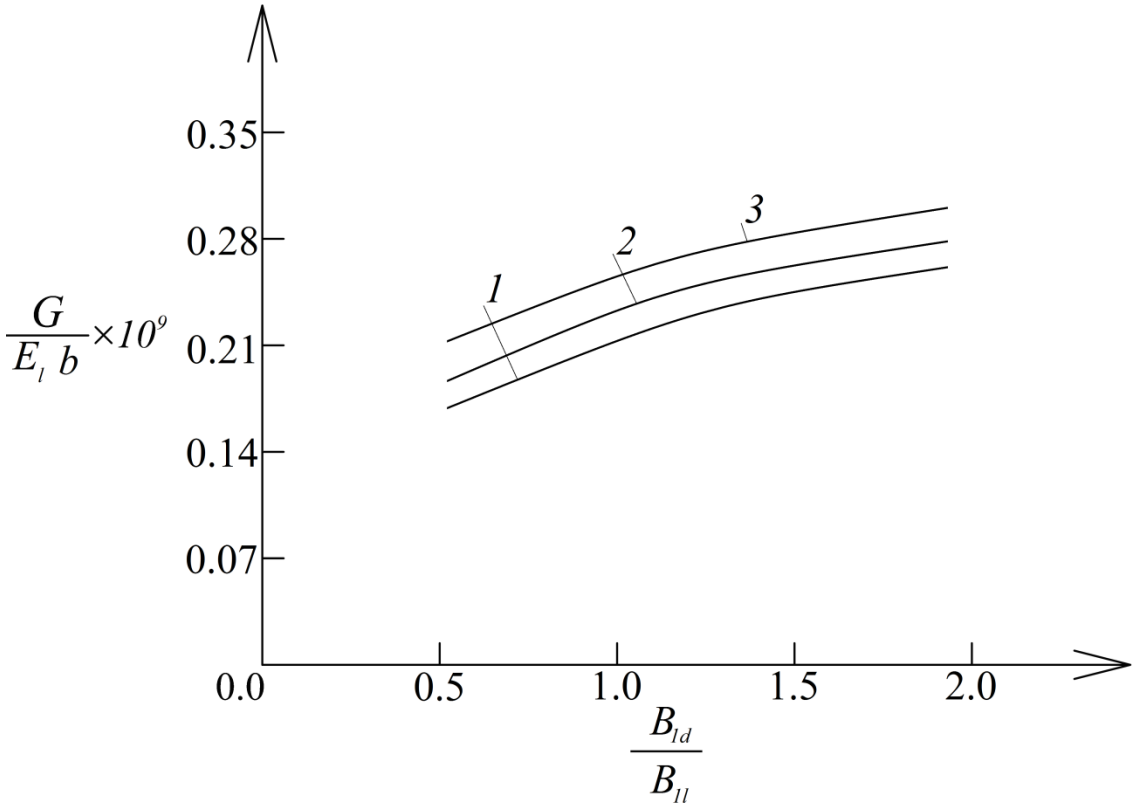

Fig. 6. The strain energy release rate in non-dimensional form presented in a function of B2d/B2l ratio (curve 1 - at B2g/B2l=0.5, curve 2 - at B2g/B2l=1.0 and curve 3 - at B2g/B2l=2.0).

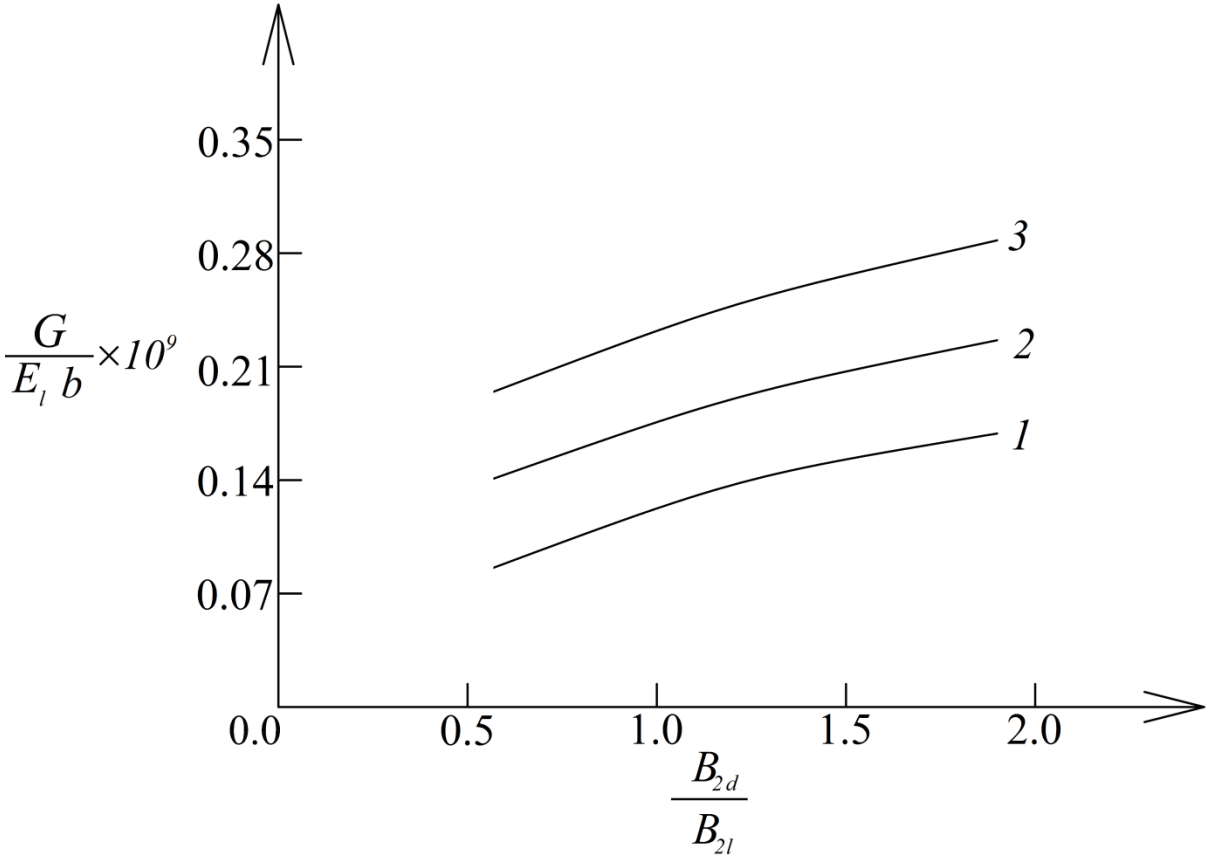

Fig. 7. The strain energy release rate in non-dimensional form presented in a function of B3d/B3l ratio (curve 1 - at B3g/B3l=0.5, curve 2 - at B3g/B3l=1.0 and curve 3 - at B3g/b3l=2.0).