

Material instability and subsequent restabilization

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Abstract

Homogenization theory is applied to the design of materials capable of displaying unexpected behaviours. In particular, a simple model shows that for certain radial paths in stress space: (i.) stability is always preserved; (ii.) compaction, shear, and mixed-mode localization bands emerge; (iii.) shear bands initially form, but later ellipticity is recovered, and finally, mixed-mode localization terminates the path. Another, more sophisticated structural model is shown to exhibit ‘islands’ of instability emerging within a broad zone of stability. This unique feature leads to unexpected behaviour, where shear bands appear, vanish and reappear along radial stress paths originating from the unloaded state.

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References

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