Implicit yield function formulation for ceramic materials

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ABSTRACT

The constitutive modelling of granular, quasi-brittle and ceramic materials is based on yield (or damage) functions, which may exhibit features (for instance, lack of convexity, or branches where the values go to infinity, or 'false elastic domains' [1]) preventing the use of efficient return-mapping integration schemes. This problem is solved by proposing a general construction strategy to define an implicitly defined convex yield function starting from any convex yield surface [2]. Based on this implicit definition of the yield function, a return-mapping integration scheme is implemented and tested for elastic–plastic (or damaging) rate equations. The scheme is general and, although it introduces a numerical cost when compared to situations where the scheme is not needed, is demonstrated to perform correctly and accurately.
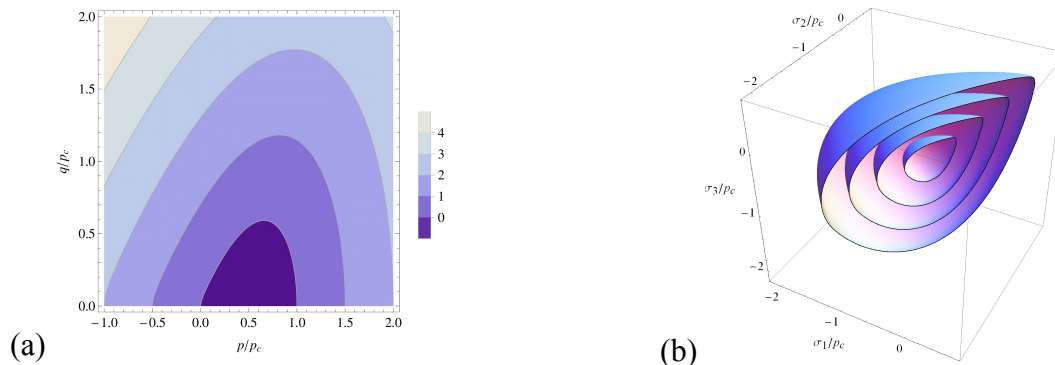
The iso-lines (iso-surfaces) of the implicit BP yield function: (a) in the (p,q)-space, (b) in the principal stress space

REFERENCES

[1] R.M. Brannon, S. Leelavanichkul, "A multi-stage return algorithm for solving the classical damage component of constitutive models for rocks, ceramics, and other rock-like media", *International Journal of Fracture*, **163**, 133-149 (2010).

[2] S. Stupkiewicz, R. Denzer, A. Piccolroaz, D. Bigoni, "Implicit yield function formulation for granular and rock-like materials", *Computational Mechanics*, **54**, 1163-1173 (2014).