A Constrained Large Time Increment Method for Modelling Quasi-Brittle Failure

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The numerical modelling of the post-peak behaviour of quasi-brittle solids plays an important role in assessing the residual strength and failure mode of a structure. The mechanical response of these structures often exhibits snap-back behaviour (i.e. a decrease of both stress and strain under softening), necessitating the use of a robust algorithm capable of tracing this highly non-linear response. In this contribution, a non-incremental LATIN-based solution procedure capable of calculating the exact and complete loading behaviour, including snap-backs, is developed.

Unlike conventional incremental-iterative algorithms (e.g. the Newton Raphson scheme), the LATIN algorithm calculates the whole time domain in one single increment [1]. At variance with existing LATIN algorithms, the presented solution scheme can trace snap-back behaviour without the need for switching to conventional step-by-step procedures [2].

Although many advances have been made in incremental-iterative algorithms, they often require problem-specific adaptations such as the *a priori* selection of the most critical degrees of freedom [3]. However, in many large-scale engineering problems, these critical degrees of freedom are not known in advance. In the presented solution procedure, these degrees of freedom are automatically selected, rendering the algorithm to be more general.

Special attention will be given to implementational aspects and the choice of the algorithmic variables. Finally, the performance and robustness of the proposed algorithm is demonstrated by means of several numerical examples, including a GFEM-based mesoscopic masonry model involving many nonlinearities [4].

References

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