

Anisotropic continuum damage constitutive framework for quasi-brittle materials including progressive crack closure effect: application to concrete

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ABSTRACT

Within the framework of continuum damage mechanics [1], several anisotropic damage constitutive models have been proposed in the literature [2] to represent the degradation of quasi-brittle materials. The benefits of such models arise from the fact that they fit the principles of the continuum mechanic enabling easy numerical implementation in the majority of finite element software [3]. The present paper proposes a new class of anisotropic damage models characterized by its ability to model nonlinear progressive stiffness recovery with the possibility to introduce irreversible strains. The theoretical framework explores some results from the matrix functions theory. Further mathematical features are established for sets of functions called here the opening (close) crack functions which are needed to control the material behaviour when switching from tension to compression. The thermodynamic consistency condition is fulfilled as long as the damage variable and the crack functions satisfy specific conditions. The robustness of the model is illustrated by considering different numerical tests.

REFERENCES

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