

A NONLOCAL SOFTENING PLASTICITY MODEL FOR CONCRETE

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A material model for FEM-based fracture simulations of plain concrete structures based on the theory of nonlocal continuum is presented. A softening plasticity model suitable for the simulation of mode-I fracture is chosen. Its regularization with respect to the strain localization problem is achieved by means of an integral-type nonlocal averaging procedure of the softening parameter similar to the formulation proposed by [1].

The model is applied to numerical simulations of various academic benchmark problems.

A possible extension of the model with respect to the strong discontinuity approach (SDA) [2] – capable of capturing discrete cracks by embedding discontinuities in the displacement field – is sketched. A transition from the nonlocal regularized continuum to an embedded crack formulation at a certain stage of material degradation could cover the wide spectrum of concrete damage from micro-cracking to the evolution of macroscopic cracks in the same model.

The presented approach is developed and analyzed in the framework of the European thematic network *Integrity Assessment of Large Concrete Dams (NW-IALAD)* [3]. The project serves as a base to conduct a state of the art review on integrity and safety assessment tools for concrete dams and consists of several work-packages (WP) subdivided into task-groups (TG). The objective of WP2/TG2 is a systematic comparison of material models for concrete. It provides comprehensive information on concrete-specific benchmark tests as well as on different approaches aiming at their numerical analyses. To this end a web-based database containing tests on plain concrete, subjected to 2D and 3D stress states, descriptions of material models for concrete and comparisons of numerical results with experimental data is developed.

References

- [1] Z.P. Bažant, and F.-B. Lin, “Non-local Yield Limit Degradation,” *International Journal for Numerical Methods in Engineering*, v. 26, p. 1805-1823, 1988.
- [2] M. Jirásek, and T. Belytschko, “Computational Resolution of Strong Discontinuities,” In: H.A. Mang, F.G. Rammerstorfer, J. Eberhardsteiner, *Proceedings of the Fifth World Congress on Computational Mechanics (WCCM V)*, Vienna University of Technology, Vienna, 2002.
- [3] NW-IALAD. “Integrity Assessment of Large Concrete Dams,” <http://nw-ialad.uibk.ac.at>, 2003.