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Three-dimensional visco-elasto-plasto-damage model for concrete in meso-scale

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A novel 3D comprehensive visco-elasto-plasto damage constitutive model of concrete is proposed to analyse the behaviour of concrete under long-term and cyclic loadings. This model combines the visco-elasticy and plasticity theories together with damage mechanics. The paper aims at providing an efficient model capable of predicting all the hysteretic characteristics of concrete material during cyclic loadings, taking into account time-dependent effects. The visco-elastic part is modeled within the framework of the linear visco-elasticity theory. The creep function is evaluated via the B3 model by Bažant and Baweja [1], and implemented with the exponential algorithm. The modified Menetrey-Willam [2, 3] pressure-dependent yield surface and a nonassociative flow rule are used for the plastic formulation of the model. The damage part of the model considers two exponential damage parameters, one in tension and one in compression, accounting for a realistic description of the transition from tensile to compressive failure [4]. The proposed model is calibrated and compared with uniaxial and multiaxial experimental tests.

REFERENCES

[1] Bažant, Z.P., Baweja, S. Creep and shrinkage prediction model for analysis and design of concrete structures: Model b3. ACI Special Publications (2000) 194: 1-84.
[2] Menetrey, P., Willam, K.J. Triaxial failure criterion for concrete and its generalization. Structural Journal (1995) 92(**3**): 311-318.
[3] Mazzucco, G. Pomaro, B. Xotta, G., Majorana, C., Salomoni, V.A. Tomography reconstruction of concrete materials for mesoscale modelling. (2020) Engineering Computations 37(**7**): 2275-2291.
[4] Grassl, P., Xenos, D., Nyström, U., Rempling, R., Gylltoft, K. CDPM2: A damage-plasticity approach to modelling the failure of concrete. International Journal of Solids and Structures (2013) 50(**24**): 3805-3816.