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EXPERIMENTAL VALIDATION OF CONSTITUTIVE MODELS FOR ASSESSMENT OF THE CRACKING RISK AT THE EARLY AGES

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Abstract. *In the first days after casting, concrete undergoes important volume changes due to cement hydration and autogenous shrinkage. In massive structures, such as thick walls, dam spillways or nuclear vessels, the volume changes in the hardening phase can lead to premature cracking, which might impair the structure function and service life. For a proper assessment of the structure behaviour, the calculation of the developed stresses is paramount. This is a complex calculation process, because not only the volume changes have to be realistically quantified, but also the mechanical concrete properties, which vary rapidly in the early ages, have to be truthfully simulated. Recently, new test setups have been developed for measuring the concrete stresses developed in the early ages. The results of such tests have been published in the literature, as benchmarks for the calibration and validation of numerical models. In this work, the benchmark tests used within the recently concluded COST action TU1404 are employed for validation of thermo-mechanical finite-element analysis methodologies. Various approaches are used to simulate the viscoelastic early-age concrete behaviour: the double power law (DPL); the modified DPL with variable instantaneous modulus; the B3 model; and the modified B3 model to account for the increasing creep deformations in the first hours after the initial concrete setting. It was concluded that the B3 model provides results having a good agreement with experiments if the aforementioned modification is implemented.*

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