Concrete experiences important volume changes, due to cement hydration and autogenous shrinkage in the early ages and due to drying in the long-term. In massive structures, such as thick walls, dam spillways or nuclear vessels, the volume changes can lead to 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 and keep evolving until the long-term, have to be truthfully simulated. Recently, new test setups have been developed for measuring the concrete stresses developed in the early ages. New approaches have also been proposed for the constitutive modelling of basic and drying creep effects.
This work presents a thermo-hygro-mechanical analysis methodology for calculation of the serviceability behaviour of restrained reinforced concrete structures, since the early ages until the long-term. Validation tasks, based on experimental results reported in the literature, are also discussed. The analysis framework is then applied to the study of the crack formation in a thick, restrained, slab-like structure.

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