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Thomaz Eduardo Teixeira Buttignol

Mackenzie Presbyterian University, Brazil

Transient creep in plain and fiber reinforced concrete structures subjected to a compressive load at high temperature

The prediction of transient creep involves a lot of uncertainties due to its complex mechanisms of activation. Transient creep is seated in the cement paste and occurs due to hygrothermal conditions: water evaporation and CSH dehydration. Above 400ºC, it is accelerated by the aggregates geomechanical properties decay. There is also a thermal mismatch between aggregate expansion and cement paste shrinkage after 150ºC, leading to concrete microcracking. As a result, due to concrete complex behavior and the coupling effects of the different strain components (viscous+elastic+plastic+thermal) at high temperature, it is a very difficult task to uncouple the viscous strain component (creep) from other thermomechanical strain sources. In practice, transient creep can be described accurately enough by the concept of LITS (Load Induced Thermal Strains), which is defined as the difference between the total strain, measured on a preloaded specimen, and the free thermal strain, measured on an unloaded specimen, subtracting the initial elastic deformation at 20°C. In order to investigate transient creep phenomenon in plain and fiber reinforced concrete structures, a new LITS semi-empirical model is proposed, recognizing concrete as a heterogeneous biphasic material (aggregates + matrix) and assuming that LITS is the sum of thermomechanical and thermochemical strain contributions. The semi-empirical model is compared with experimental tests performed on steel fiber reinforced concrete samples with 11-years-old. Moreover, a mesoscopic analysis was carried out in Abaqus in order to uncouple LITS strain contributions and highlight the effects of the boundary conditions, aggregates decomposition and concrete dehydration.

Biography

Thomaz Eduardo Teixeira Buttignol has completed his PhD with distinction from Politecnico di Milano, Italy, and postdoctoral studies from Polytechnic School, University of Sao Paulo, Brazil. He is a doctor professor from Mackenzie Presbyterian University and a researcher from Polytechnic School, University of Sao Paulo. He has more than 10 years of professional experience, with dozens of design and construction projects related to soil nailing, soil settlement, and concrete structural design. He has published more than 10 papers in reputed journals and international conferences and has been serving as an editorial board member of Ibracon Materials and Structural Journal.

butignol@hotmail.com

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