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Project Abstract

Main focus of the research project is to develop new numerical models for behaviour of steel and concrete structures exposed to fire. Development of numerical models is accompanied with experimental analysis on material and structural level, in order to test the capabilities of developed models. Current research is focused on development of hybrid numerical model, comprised of 3D heat transfer model, nonlinear model for stress-strain distribution over the cross section and 3D Bernoulli beam model for structure discretization. Particular interest in model development represents the implementation of implicit creep model for steel structures, and implicit transient-creep model for concrete structures. Creep strain in steel and transient-creep strain in concrete increase the complexity of the structure calculation procedures, especially if they are implemented explicitly, through calculation of moment-curvature curves of the cross-section. EN1992-1-2 and EN1993-1-2 present stress-strain curves in which creep and transient-creep is considered implicitly, by modifying stress-strain curves and reducing the material modulus as the stress increases. In that way, additional material effects that occur at high temperatures exist only within the stress-strain curves, without the need of complex calculation procedures. Current research is focused on how to modify the stress-strain curves with calculated values of creep (transient-creep) strain that occur under varying temperature. Validity of the implemented implicit creep model is tested on a series of steel beam elements with 2.5 m span, vertically and eccentrically loaded, heated with different heating regimes until failure occurs. In addition, validity of the model is tested on results of experiment carried out on prestressed hollow core concrete slab with 8.0 span, exposed to ISO curve. In addition, material properties at high temperatures of both the steel and concrete material are determined to obtain basic input parameters for the developed model. Purpose of the presented research is the development of advanced calculation models that are suitable for engineering application.