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ABSTRACT

A Unified Approach in Modelling Strain and Heating-Rate Effects in Metal Structures Exposed to Fire

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This keynote lecture focuses on the challenges of performing time-dependent analyses of metal structures (steel and aluminium) under fire conditions, and introduces a unified material model designed for effective implementation in FEM software. Time-dependent analysis of fire-exposed metallic structures necessitates the explicit or implicit consideration of time-dependent strain components, primarily creep, which develops in response to specific thermal and mechanical boundary conditions. The lecture will briefly review recently developed explicit creep models, along with the implicit approaches incorporated within structural Eurocodes for metallic materials. Supporting experimental studies demonstrating the influence of creep on the load-bearing capacity of structural members will also be presented. The core of the lecture will be the presentation of a unified rheological model. This model offers a unified approach to modelling the time-dependent behaviour of metallic structures by explicitly accounting for the effects of both strain-rate and heating-rate variability on the resulting strain. The application of this unified rheological model will be demonstrated through its use in modelling various stationary and transient experimental material studies.

References

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Torić, Neno; Burgess, Ian: Towards an advanced, time-dependent analysis of fire exposed steel structures // Proceedings of the International Conference in Ljubljana, 10-11 June, 2021 in edition of Applications of Structural Fire Engineering. Ljubljana: Fakulteta za gradbeništvo in geodezijo Univerze v Ljubljani, 2021. str. 13-17