ABSTRACT

Six temperature-dependent emissivity models were used to determine its impact on the thermomechanical behaviour of steel members as compared to using a constant value suggested by the Eurocode. The members—a 3 m beam and a 3 m column—were part of an arbitrarily chosen concrete compartment of office occupancy with dimensions of 5 m × 5 m × 3 m, and which consists of a 1 m × 2 m door and a 1 m × 1 m window openings. Using Abaqus CAE/2018, these members were modelled and subjected to two cases of heating: uniform and localized. The compartment's parametric temperature-time curve and the equivalent ISO 834 standard curve were applied to the members as the uniform heating case, while the localized fire curve was applied as the localized heating case. The results revealed that, on average, the Eurocode overestimated the temperature by as much as 43.09% and underestimated it by 9.33% for the case with an intervening medium between the fire and the surface. The Eurocode prediction for maximum normal stress varied from an overestimation of 56.31% to an underestimation of 9.06%. It generally overestimated the maximum deflection by as high as 48.65%. Lastly, the results for the final deflection varied from an overestimation of 46.67% and underestimation of 10.43%. The variability of the results highlighted the importance of using an appropriate emissivity model to accurately predict the performance of fire-exposed steel members.