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Thermo-mechanical behavior of steel-concrete composite columns under natural fire including heating and cooling phases

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Abstract : In recent years, concrete filled tubular (CFT) columns have become popular among designers and structural engineers, due to a series of highly appreciated advantages: high load-bearing capacity, high seismic resistance, attractive appearance, reduced column footing, fast construction technology and high fire resistance without external protection. In a fire, the degradation of the material properties will cause CFT columns to become highly nonlinear and inelastic, which makes it quite difficult to predict their failure. In fact, it is possible to fail during heating or cooling phase of fire. In this paper, the behavior of axially loaded concrete filled square hollow section columns subjected to natural fire conditions has been studied. The main objective of this study is to highlight the phenomenon of delayed collapse of this type of columns during or after the cooling phase of a fire, and then analyze the influence of section size. The results show that critical conditions with respect to delayed failure arise much more for massive sections.

Keywords : Natural fire, Fire resistance, composite column, cooling phase, residual strength