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| **Abstract:** |
| This paper addresses the efficiency of thermal insulation layers applied to protect structural elements strengthened by fiber-reinforced polymers (FRP) in the case of fire event. The paper presents numerical modeling and nonlinear analysis of reinforced concrete (RC) columns externally strengthened by FRP and protected by thermal insulation layers when subjected to elevated temperature specified by standard fire tests, in order to predict their residual capacity and fire endurance. The adopted numerical approach uses commercial software includes heat transfer, variation of thermal and mechanical properties of concrete, steel reinforcement, FRP and insulation material with elevated temperature. The numerical results show good agreement with published results of full-scale fire tests. A parametric study was conducted to investigate the influence of several variables on the structural response and residual capacity of insulated FRP-confined columns loaded by service loads when exposed to fire. The residual capacity of FRP-confined RC column was affected by concrete grade and insulation material and was shown to improve substantially by increasing the concrete cover and insulation layer thickness. By increasing the VG insulation layer thickness 15, 32, 44, 57 mm, the loss in column capacity after 5 hours of fire was 30%, 13%, 7% and 5%, respectively. The obtained results demonstrate the validity of the presented approach for estimation of fire endurance and residual strength, as an alternative for fire testing, and for design of fire protection layers for FRP-confined RC columns. |