Finite Element Modeling of Insulated FRP Strengthened Reinforced Concrete Columns at High Temperatures

Recently, Fiber Reinforced Polymers (FRP) have been successfully used for retrofitting or strengthening of existing concrete structural members due to their superior properties such as high strength, corrosion resistance and ease of application. However, their behavior under elevated temperature, likely to occur in case of fire, is a problem that presents a threat to the strengthened member. This paper presents numerical investigation of reinforced concrete (RC) columns strengthened with FRP and insulated by a thermal resisting coating under service load and fire conditions. The finite element numerical modeling and nonlinear analysis are made using the general purpose software ANSYS 12.1. Numerical modeling is made for FRP-strengthened and insulated RC columns that have been experimentally tested under standard fire tests in the published literature. The obtained numerical results are in good agreement with the experimental ones regarding the temperature distribution and axial deformations. Thus, the presented modeling gives an economic tool to investigate the performance of loaded FRP strengthened columns under high temperatures. Furthermore, the model can be used to design thermal protection layers for FRP strengthened RC columns to satisfy fire resistance requirements specified in building codes and standards. Keywords: Nonlinear analysis, finite elements, model