Modeling of Shear Capacity of RC Beams Strengthened with FRP Sheets Based on FE Simulation

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Abstract:

In this paper, a three-dimensional finite-element (FE) analysis was carried out to study the effect of new variables on predicting the ultimate shear capacity of reinforced concrete (RC) beams strengthened with fiber-reinforced polymer (FRP) sheets. 55 specimens were analyzed by considering the effect of beam width, concrete strength, shear span-to-depth ratio, FRP thickness, and strengthening configuration (completely wrapped, U-jacketing, and side bonding). Experimental results of 274 beams collected from previous published work were analyzed to verify the accuracy of the proposed model. The results show that lateral strain along the top and the bottom of beams are affected by all these variables. This was not considered in previous studies. The results also indicate that the suggested model can calculate the shear capacity of RC beams strengthened with FRP sheets with higher accuracy than existing models, with coefficients of variation reaching 18.9% for side bonding, 17.0% for U-jacketing, and 18.3% for completely wrapped, respectively.

Keywords:

Finite element method; Fiber reinforced polymer; Simulation; Concrete beams; Reinforced concrete.

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