Finite Element Modeling of the Shear Capacity of RC Beams Strengthened with FRP Sheets by Considering Different Failure Modes.

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Abstract:

In this study, three-dimensional (3D) finite element (FE) analyses were carried out to study the effects of several variables on the failure modes and ultimate shear capacity of reinforced concrete (RC) beams strengthened with fiber-reinforced polymer (FRP) sheets. Fifty-eight cases were analyzed by FE modeling. The parameters considered to affect the failure modes and the shear capacity included the beam width, the concrete strength, the height and thickness of the FRP sheet, the elastic modulus of the FRP and the strengthening configuration (complete wrapping, U-jacketing, and side bonding). A model for predicting the failure mode and the shear capacity were proposed on the basis of the results of the parametric analysis. Experimental results for 307 beams collected from previously published work were analyzed to verify the accuracy of the proposed model. The results show that the failure modes of RC beams are affected by the parameters considered and can be predicted by the proposed model. The results also indicate that the proposed model can be used to calculate the shear capacity of RC beams strengthened with FRP sheets and to predict the failure mode with greater accuracy than existing models.

Keywords:

Finite element; Shear capacity; FRP sheets; Shear model; Shear failure mode

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