Combined cohesive-bridging zone model for prediction of the debonding between the FRP and concrete beam interface with effect of adherend shear deformations

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Abstract/Résumé : In this paper, a new analytical method is developed to simulate the debonding procedure between the FRP and concrete interface. The debonding initiation and growth at the interface is modeled by cohesive zone model with a particle interlocking zone modeled by a bridging zone model. Due to the particle interlocking and friction, a residual shear stress exists in this zone, but it is reduced to zero with slip. In all zones of the debonding processes, the adherend shear deformations have been included by assuming a parabolic shear stress through the thickness of the adherends which cheeked the cubic variation of longitudinal displacements function, while all existing solutions neglect this effect. Next, solutions of the FRP plate force and interface shear stress are obtained for different zones of the debonding processes by using the proposed stress-slip law. Obtained results of the interfacial shear stress distribution and pull force are compared to other results given by the literature. Parametric studies are carried out to demonstrate the effect of the mechanical properties and thickness variations of FRP, concrete and adhesive, on the interface debonding. Indeed, limits of elastic, softening, bridging and debonding zones are reached after those computed by other models which neglect adherent shear deformations. Moreover, pull force in the four zones is more important than that calculated without the shear lag model; with considered the thickness effect. Therefore we can say that, by the use of the high order function of shear deformation, interfacial shear stresses and pull forces are suitably approximated and our reinforced concrete beam becomes stiffer.

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