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A Shear-Lag Model for Functionally Graded Adhesive Anchors

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Abstract

A shear-lag model for stress transfer through an adhesive layer of variable stiffness joining an anchor rod and the concrete is presented and the effect of such an inhomogeneous bondline on interfacial shear stress distribution in comparison with that of a homogeneous bondline anchor subjected to monotonic axial tension is investigated. A closed-form solution is presented for arbitrary distribution of shear stiffness of the bondline considering both bonded and debonded embedded-end conditions. Subsequently, the specific cases of linear and constant distribution of stiffness are discussed in detail, and it is shown how the general solution can be simplified for these examples. For validation, the distribution of shear stress along the bondline for the aforementioned cases is compared with that of equivalent axisymmetric Finite Element (FE) models and the results are found to be in good agreement. The theoretical solution developed can be readily used to evaluate the enhanced pull-out performance of post-installed adhesive anchors. Variable stiffness adhesive interfaces deserve an interest in practical applications ei-

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