Departmental Seminar

Department of Civil Engineering and Engineering Mechanics
Columbia University

Elastic Analysis Of A Bi-Layered Cylinder Under Axial Loading

Tuesday, November 16th @ 2:30pm

644 MUDD

Pablo Prieto-Muñoz
Civil Engineering and Engineering Mechanics
Columbia University

This presentation focuses on an elastic analysis of two very commonly used elements in civil engineering infrastructure: adhesive anchors and protective wire coatings. Adhesive anchors have been widely used, but recent accidents have shown that their current design procedure cannot accurately account for the creep behavior of the adhesives. In order to understand the creep deformation of adhesive anchors and develop a new design method, a new elastic model is developed, considering an elastic core bonded to a rigid hole through an elastic adhesive. Compared with the existing design method, the proposed model provides the elastic fields in both the elastic core and the adhesive layer, which makes it possible to capture these different failure mechanisms. This solution will provide a foundation for our future viscoelastic modeling and characterization of an epoxy adhesive anchor system.

Protective coatings have been applied on bridge cables for corrosion and erosion protection. When a wire with a brittle coating is subjected to an increasing tensile load, opening-mode fractures first form perpendicular to the tensile axis. When fracture spacing reduces to a certain value, fracture density is saturated and finally fragmentation of coating materials may be induced. This presentation presents a linear elastic stress analysis of open-mode fractures using elastic governing equations and a weak form stress boundary condition. The derived stress fields in the brittle coating can be used to predict when interfacial debonding will occur. Both of the models' assumptions and solutions are then validated using an axisymmetric finite element model. The solution will be used in fracture analysis and testing of polyurea coatings on wires.