Title Development of a Fiber Modeling and Analysis Framework for Complex Composite Cross-sections.

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Abstract
This study presents a developmental framework for fiber modeling and analysis of complex composite cross-section of arbitrary shape with openings and possible inclusion of prestressing tendons, under load and time domains. In the modeling procedure, the cross-section has been discretized into polygons, rectangles and points to represent the concrete, steel and reinforcing bars, respectively. This procedure is intended to reduce the computational cost in the numerical evaluation of integrals involving stresses in the materials. Inherent to the framework are various material models or the uniaxial stress-strain relationships for every material, strain modifiers such as shrinkage and thermal changes, stress modifiers such as creep, tension stiffening, residual stresses due to fire, local buckling, strain hardening of steel and relaxation of prestressing tendons. Due to the complexities of geometries and loading conditions, i.e. axial force and biaxial bending and arbitrary cross-section with openings, an approach in numerical modeling where the section is revolved into the desired axis of bending, and then the respective resultant and bending moment are determined, was implemented using Visual Basic .Net. Results were compared with the past test results and related studies found in the literature for verification purposes.

Keywords Fiber modeling, modeling and analysis, framework, composite cross-sections.