Ge Ji

Thesis

On the Numerical Solution of Laplace's Equation with Nonlinear Boundary Conditions for Corrosion of Steel in Concrete

Abstract

To overcome the difficulties associated with the solution of Laplace's equation for electric potentials with nonlinear polarized boundary conditions, an improved two-dimensional nonlinear finite element technique was developed to model steel corrosion in concrete members. The nonlinear solution algorithm was implemented as a Windows-based computer program using Visual Basic.Net 2003. The program uses a finite element engine that was previously developed at Carleton University, Condur, to solve Laplace's equation. With the new approach, the convergence rate and the stability of the nonlinear solution are significantly improved. The sensitivity of the results and convergence of the solution with respect to element size, anode-to-cathode ratio and concrete resistivity are investigated. The effect of the selection of corrosion parameters on the solution is also studied.

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Supervisor

Isgor