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Numerical analysis and computing of free boundary problems for concrete carbonation chemical corrosion

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Abstract

This paper deals with the construction, analysis and computation of a numerical method to solve a moving boundary coupled nonlinear system of parabolic reaction-diffusion equations, arising in concrete carbonation problems. By means of a front-fixing transformation, the domain of the problem becomes fixed, and the position of the moving carbonation front has to be determined together with the mass concentrations of the involved chemical species. Qualitative properties like positivity and stability of the numerical solution are established. Spatial monotone behaviour of the solution is also proved. Numerical examples illustrate these results.

Keywords: Concrete carbonation chemical corrosion, Free boundary problems, Nonlinear PDE system, Numerical analysis, Finite difference methods.

1. Introduction

The effect of concrete carbonation in buildings and civil works is a relevant issue in civil engineering construction and architecture due to the deterioration

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