



Numerical Modeling of AAR

Victor Saouma

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This reference book presents the theory and methodology to conduct a finite element assessment of concrete structures subjected to chemically induced volumetric expansion in general and alkali aggregate reaction in particular. It is limited to models developed by the author, and focuses on how to best address a simple question: if a structure suffers from AAR, how is its structural integrity jeopardized, and when would the reaction end.

Subjects treated are:

- Brief overview of AAR: nature of the chemical reactions, AAR in both dams and nuclear power plants, and how does it impact the mechanical properties of concrete.
- Constitutive model for both the AAR expansion, and concrete nonlinearities (both smeared and discrete crack models).
- Validation of the model along with a parametric study to assess what are the critical parameters in a study.
- Selection of material properties for an AAR finite element simulation, followed by applications in dams and massive reinforced concrete structures.
- Micro Model for improved understanding of the essence of the reaction, along with a newly proposed mathematical model for the kinetics of the reaction.
- Review of relevant procedures to estimate the residual expansion of a structure suffering from AAR, along with a proposed approach to determine when the reaction will end.

The book is extensively illustrated with numerous figures and provides guidance to engineers confronted with swelling in concrete infrastructures.

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