Synopsis

Thesis Title : MODELLING BASIC CREEP OF CONCRETE USING ADAPTIVE LINK MECHANISM

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This thesis attempts to model the basic creep of concrete. Creep of concrete is a time dependent phenomenon and it affects the safety and serviceability of structural components. While number of models has been developed to predict the creep of concrete, the performance of these models suggests that there is considerable scope for improvement.

In the present study, performance of dissolution precipitation mechanism and dissolution precipitation with modified adaptive link mechanism has been studied using the experimentally determined creep compliance values reported in the literature. While dissolution precipitation mechanism considerably underestimates the creep, dissolution precipitation with modified adaptive link mechanism shows a fairly good agreement with the experimental observation. It is modelled on the basis of bond breakage and restoration mechanism which is the cause of deformation. However, the model remains silent on the types of bonds broken and restored.

A model to determine basic creep in concrete, based on the types of links that are formed, broken and replaced when concrete undergoes aging is proposed in the present study. The parameters of the proposed model are obtained by fitting with 2859 data points of basic creep compliances given in creep and shrinkage data base developed by Bazant and co-workers. The performance of the model has been studied and it is noted that model performs fairly in most of the ranges of parameters considered.

A probabilistic analysis of basic creep using the proposed model has been carried out to study the effect of uncertainties in various parameters considered in the model on basic creep compliance. Monte Carlo simulation with ten thousand simulation cycles are used, and the statistical properties of creep compliance for different durations of loading are estimated. From the comparison of experimentally observed creep compliance values with the results obtained from probabilistic analysis, it is noted that experimentally obtained creep compliance values are well within the bounds obtained from probabilistic analysis.