Assessment of structural performance of concrete-filled steel tubular arch with interval viscoelastic effects

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Abstract

A computational efficient approach is presented in this paper for assessing the time-dependent structural behaviour of concrete-filled steel tubular arch with considerations of uncertain viscoelastic effects. Among many influential factors, the intricate viscoelastic effects of creep and shrinkage of concrete core are particularly investigated due to their inevitability in affecting the performance of the structures involving concrete as constructional material. Mercurial effects on structural performance due to creep and shrinkage have been constantly observed in engineering practice. It is rational to model these two aspects as uncertain-but-bounded parameters, so the integrity of safety assessment on CFST arch can be further reinforced.

In this study, the structural behaviour of CFST arch is assessed under the influence of uncertain creep and shrinkage of the concrete core. The uncertain yet time-dependent effects of creep and shrinkage on the long-term structural behaviour are investigated, such that the worst and best scenarios of structural behaviour at each specific loading time can be precisely calculated.

The novelty of this study is that the uncertain time-dependent structural behaviour of CFST arch involving creep and shrinkage is thoroughly investigated. One efficient approach is presented to quantitatively offer a time based profile of the uncertain structural behaviour for CFST arches against uncertain effects, such that the evolution of the structural behavior can be predicted through the service life. Practical example is investigated to illustrate the capability and efficiency of the proposed computational scheme.

Keywords: Creep, Shrinkage, Uncertainty, CFST arch, Time-dependent behaviour, Safety assessment.