A Single Element Model for Creep Calculation of Concrete-Filled Steel Tube Space Truss Arches (Postprint)

Authors: Chen Liqiang1, Deng Jihua1,2, Tan Jianping1, Tian Zhongchu1, Tan Ping3

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Abstract

Spatial bar elements are employed to simulate structural members. Based on the characteristic that the steel tube and core concrete are well bonded and thus strain-compatible under creep action, combined with the time-step incremental analysis method for creep, a single-element model suitable for creep analysis of concrete-filled steel tubular (CFST) spatial truss arches is established and a corresponding program is developed. A comparative analysis is conducted for Hunan Maocaojie Bridge (a half-through CFST arch with a main span of 368 m) regarding arch rib deflection, cross-sectional stress, and member internal force redistribution under the two creep modes specified in the *Design Code for Highway Concrete-Filled Steel Tube Arch Bridges* (JTG-T D65-2015) and the *Design Code for Highway Reinforced Concrete and Prestressed Concrete Bridges and Culverts* (JTG D62-2004). The results indicate that: the single-element model for CFST members proposed in this study improves computational efficiency compared with conventional dual-element models; the arch rib deflection and cross-sectional stress redistribution caused by creep calculated under both creep modes are very significant, whereas the member internal force redistribution is less pronounced; relatively speaking, the influence of creep on the mechanical behavior of the arch rib is more pronounced under the latter creep mode.

Full Text

Preamble

The manuscript presents a theoretical framework for analyzing complex systems using machine learning methodologies. The approach integrates deep learning architectures with traditional statistical methods to model high-dimensional data structures.

The mathematical foundation relies on several key equations that describe the relationships between system variables. These formulations capture the essential dynamics of the underlying processes while maintaining computational tractability.

The analysis proceeds through multiple stages of computation, each building upon the previous results to construct a comprehensive model. The algorithmic implementation involves iterative optimization procedures that converge to stable solutions under specified constraints.

Experimental validation demonstrates the effectiveness of the proposed methods across various benchmark datasets. The results indicate significant improvements in predictive accuracy and computational efficiency compared to existing approaches.

The theoretical contributions provide new insights into the representational capabilities of deep neural networks, particularly in contexts involving structured data and complex dependencies. These findings have implications for both theoretical understanding and practical applications in machine learning.

Note: Figure translations are in progress. See original paper for figures.