

Erfeng Zhao and Chengqing Wu, 2021, Long-term safety assessment of large-scale arch dam based on non-probabilistic reliability analysis, *Structures*, 32 298–312.

Abstract Long-term service status of a large-scale arch dam is affected by variations of loads and material properties with randomness and fuzziness. This study aims to resolve the problems of a variety of uncertain variables that coexist in the reliability assessment of arch dams. Firstly, a time-varying non-probabilistic reliability (N-PR) solution method of the arch dams is proposed based on the convex set model. Subsequently, non-probabilistic target reliability indexes are put forward according to the defined probabilistic reliability indexes during long-term operation of the arch dams. Afterwards, a fuzzy prediction index is formulated based on the mixed statistical model and the Info-gap model under the most unfavorable reservoir water depth, so as to timely find defects and avoid the potential failure of the arch dams. Numerical simulation on the Jinping I arch dam is conducted to validate the proposed methods. The possible failure modes and the long-term N-PR of the world's highest arch dam is appraised, and the fuzzy prediction indexes are concluded. Research results can provide a feasible way for large-scale arch dam reliability and safety assessment.

Keywords Large-scale arch dam, Non-probabilistic reliability, Convex set model, Info-gap model, Fuzzy prediction index