Reliability Analysis of stayed cables in Long-term SHM

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【Background】

In long-term Structural Health Monitoring (SHM), monitoring data often exhibits significant uncertainty due to identification uncertainties and environmental factors. This phenomenon restricts the practicality and reliability of monitoring results, preventing its widespread application in structural integrity assessment of bridges and decision-making regarding bridge maintenance and management.

【Objective】

This study aims to address monitoring uncertainty through probabilistic methods and proposes a novel reliable analysis approach for long-term monitoring processes. The method is illustrated through a case study of stayed cables in a cable-stayed bridge.

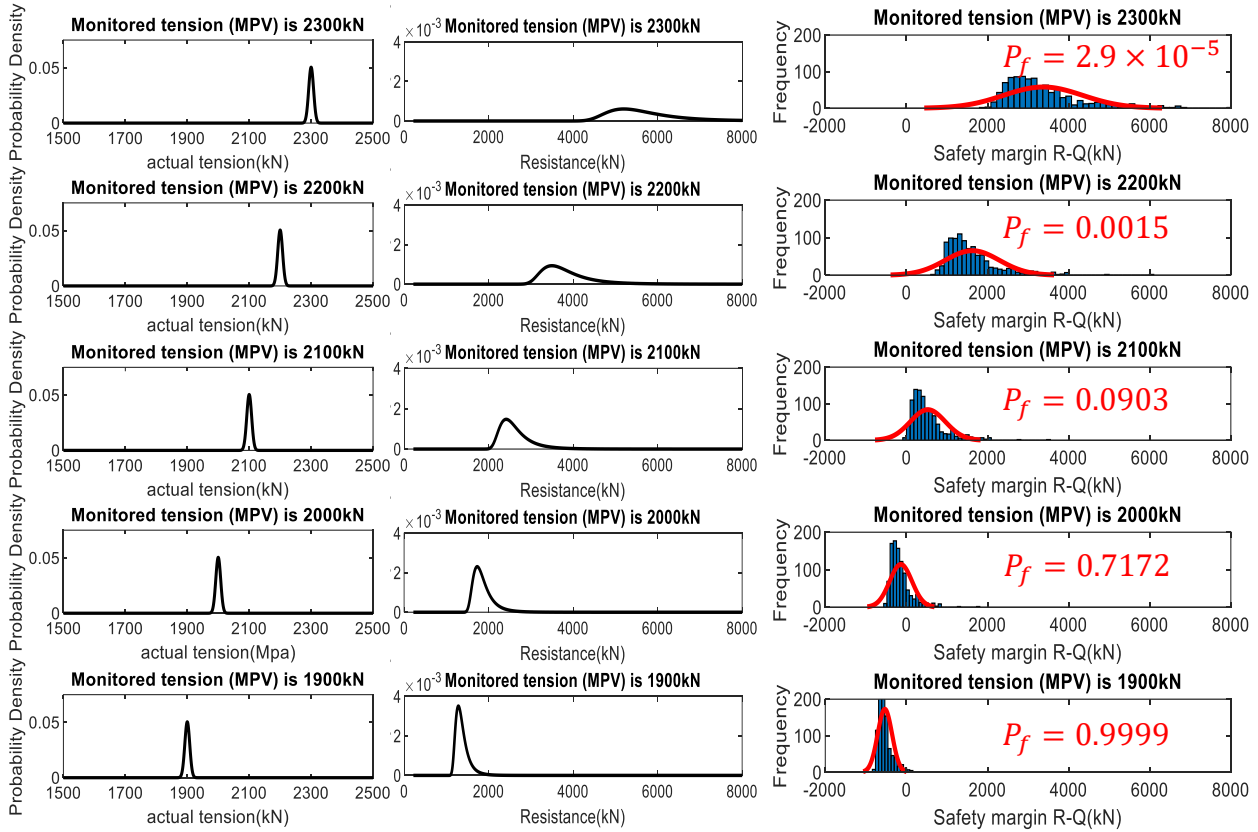
【Approach】

In this study, the mode of cable failure is defined as when the tension force due to loads exceeds the tension-carrying capacity. Let R represent the resistance (tension-carrying capacity), while Q represents the load effect (total tension applied to the cable). Because of the monitoring uncertainties, both R and Q are continuous random variables, then each has a probability density function (PDF). A series of Monte Carlo simulations are employed to generate the samples of safety margin R-Q, and the probability of failure corresponds to the probability that the event R-Q<0 occurs.

【Publication plan】

・A journal paper about probabilistic damage assessment and reliability analysis of stayed cables in long-term SHM.

【Results】



(a) Load effects Q (b) Resistance R (c) Safety margin R-Q