



Risk-based decision making using structural health monitoring information

Daigo Kawabe

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【Background】

Although the quantitative information about the state of the structure can be obtained by structural health monitoring (SHM), there is not practical way of proposing the best decision for structure authorities once the output from SHM would be obtained.

【Objective】

The objective of this study is to build a framework for decision making of four actions; “clearly healthy”, “clearly abnormal”, “sending engineers”, and “obtaining next SHM outputs” from SHM. As a case study, scour monitoring of a railway bridge pier is used to discuss the feasibility of usage of the built framework by use of identified natural frequencies during flooding in real time.

【Approach】

Whether the identified frequencies of the pier in realtime illustrates clearly anomalous or not is determined by Bayes Factors. When there are no clearly anomalous, the benefits and costs of sending inspectors are calculated. This study verifies the series of steps that if the benefits outweigh the costs, the inspectors sending is carried out using simulation data.

【Publication plan】

- AY2025 Structural Engineering Symposium
- AY2025 EVACES2025

【Results】

The values of each risk, $r(a_i)$, were calculated using artificial acceleration of simulating scouring from acceleration responses during flooding. Then the built framework could properly show the time when decisions of “clearly abnormal”, and “sending engineers” should be taken.



$$r(a_p) = \sum_{j=0}^1 P(H_j|D) C(a_p, H_j)$$

$$r(a_s) = \sum_{j=0}^1 P(H_j|D) C(a_s, H_j)$$

