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Keynote Paper

Safety assessment of coastal infrastructure via vibration monitoring and simplified model

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ABSTRACT

The upright breakwater is inevitably damaged in the lifetime since the repeated wave action causes local and global variations of geometric and boundary properties, being deviated from the as-built state. Recently, the structural safety of the caisson breakwater has become more important issue due to the extreme event like tsunami attack. So far, just a little attention has been made on the application of the vibration-based structural health monitoring (SHM) techniques to breakwater systems. That might be due to multiple reasons such as the limitation of geometric accessibility, the requirement of excitation source, and the difficulty of vibration signal analysis due to ambient wave-induced noises. In this study, the safety of upright breakwater system is assessed by using in-situ measurements and a simplified mass-spring-dashpot model allowing a few degrees of freedom. Firstly, a vibration-based method is designed to monitor dynamic characteristics and to identify a simplified analytical model from the limited in-situ measurement condition of the caisson breakwater. Secondly, acceleration signals recorded from in-situ tests on a real upright breakwater are analyzed to acquire modal responses under water level change. Thirdly, the structural identification is performed to obtain the simplified model representing the measured dynamic characteristics of the caisson structure. The structural parameters of the caisson unit is estimated from the model fine-tuning process based on the theory of modal sensitivity. Finally, the simplified model is utilized to predict vibration responses of the target caisson system under water level variation.

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