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Bridge Health Monitoring: A Review

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Abstract : Structural Health Monitoring (SHM) is a crucial and necessary practice that plays a vital role in ensuring the safety and integrity of critical structures, and in particular, bridges. The continuous monitoring of bridges for signs of damage or degradation through Bridge Health Monitoring (BHM) enables early detection of potential problems, allowing for prompt corrective action to be taken before significant damage occurs. Although all monitoring techniques aim to provide accurate and decisive information regarding the remaining useful life, safety, integrity, and serviceability of bridges, understanding the development and propagation of damage is vital for maintaining uninterrupted bridge operation. Over the years, extensive research has been conducted on BHM methods, and experts in the field have increasingly adopted new methodologies. In this article, we provide a comprehensive exploration of the various BHM approaches, including sensor-based, non-destructive testing (NDT), model-based, and artificial intelligence (AI)-based methods. We also discuss the challenges associated with BHM, including sensor placement and data acquisition, data analysis and interpretation, cost and complexity, and environmental effects, through an extensive review of relevant literature and research studies. Additionally, we examine potential solutions to these challenges and propose future research ideas to address critical gaps in BHM.

Keywords : structural health monitoring (SHM), bridge health monitoring (BHM), sensor-based methods, machine-learning algorithms, and model-based techniques, sensor placement, data acquisition, data analysis
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