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Editorial

Intelligent Bridge Health Monitoring and Assessment

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Buildings play an indispensable role in urban development. As transportation structures, bridges serve as crucial nodes in connecting different regions, promoting economic growth, and ensuring social security. However, with the extension of their service life, the performance of bridges will inevitably decline. Performance monitoring and evaluation are crucial during the life cycle of bridges [1,2] because they can provide vital scientific research significance and engineering application value for ensuring the safety of bridges and keeping road networks unblocked. The accelerating convergence of civil engineering, materials science, and artificial intelligence has sparked the interest of researchers from different disciplines in the emerging field of bridge state perception [3,4]. This Special Issue is devoted to new research and development activities with regard to the intelligent monitoring and assessment of bridges. This Special Issue on Intelligent Building Health Monitoring and Assessment features 12 papers. All these contributions effectively address the main topics of this Special Issue in a targeted effort.

According to the research topic, the published 12 papers can be divided into two major categories, i.e., monitoring and assessment. Within the monitoring category, there are two subcategories. The first is direct field monitoring. Paper [5] investigated the effect of pile foundation cutting and under-pinning processes on the stability of bridge substructures during shield tunneling. They utilized numerical simulations and on-site monitoring to study how the active underpinning process of shield tunneling pile foundations affected bridge substructure deformations. Paper [6] proposed a working stress monitoring method for prestressed rebars based on magnetic resonance, which can provide a new perspective on working stress measurements of vertical prestressed rebars. The second subcategory is indirect monitoring based on reverse deduction of monitoring data. Paper [7] proposed a novel method to perform moving load identification using MobileNetV2 and transfer learning. MobileNetV2 has a faster identification speed and requires fewer computational resources in moving load identification. Paper [8] identified moving forces by utilizing the acceleration response of a moving instrumented vehicle. This method exhibited a high recognition accuracy and a good robustness and reliability even amidst substantial environmental noise interference.

Within the assessment category, there are three subcategories. The first is experimental assessments. Paper [9] constructed a test system for the bearing characteristics of a cantilever anti-slide pile based on similarity theory. The distribution laws of internal forces and the deformation of a cantilever anti-slide pile were revealed, and an optimized calculation method for the internal force of a cantilever anti-slide pile was proposed by considering the elastoplastic characteristics of steel bars and concrete. Paper [10] designed an array-type, self-balancing pulley group loading system for a 1:10 scale model of the world's largest span arch bridge. The system can automatically calculate the required load at each loading point using ANSYS and optimize the load points at different construction stages. The second subcategory is numerical-simulation-based assessments. Paper [11] investigated the appropriate range of the inclination angle of arch ribs. A spatial finite element model

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was established to investigate the effect of different arch rib inclination angles under static loads and then verified using real bridge data. Paper [12] focused on a super-long-span concrete-filled steel tube arch bridge and conducted a nonlinear time history analysis and seismic verification calculations. The third subcategory is algorithm-based assessments. Paper [13] investigated the debonding failure between concrete and steel reinforcements. Correlation and gray correlation analyses were used to establish the index system, from which two debonding prediction models were established. Paper [14] proposed a response surface method to further improve the accuracy of alignment prediction for large-span steel–concrete composite beam track cable-stayed bridges. This method can accurately predict the alignment of rail cable-stayed bridges, thereby providing technical support for alignment control and ensuring the safe and comfortable operation of rail transportation. Paper [15] investigated the surface temperature of the steel box girders of a long-span suspension bridge via a statistical analysis. The time and space distributions of the three-dimensional temperature were studied, and a contour map was created. Based on a machine learning method and the analytical solution of Fick's second law, paper [16] analyzed the diffusion model of corrosion factors and the influence of surface concentrations.

The papers included in this Special Issue cover a wide range of topics, including the utilization of different techniques for monitoring and assessing the health of bridges. These studies provide some novel methods, models, and technological applications for bridge health monitoring, which are of great significance for the design, construction, and assessment of bridges. By employing these methods and technologies, the safe and stable operation of bridges can be effectively ensured.

Conflicts of Interest: The authors declare no conflict of interest.

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