香港科技大學
THE HONG KONG UNIVERSITY OF SCIENCE AND TECHNOLOGY

土木及環境工程學系
DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

SEMINAR

CONSIDERATIONS ON BRIDGE MONITORING AND DAMAGE DETECTION

Speaker

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Abstract

Some thoughts about the importance of bridge monitoring (BM) and damage detection in existing bridges taking into consideration the actual state of transportation infrastructure will be discussed.

The main objectives and need for bridge monitoring are introduced first, following with a description of the data collection techniques used in BM, either in the stage of the creation of the virtual asset or during the operational phase. From them, strain and temperature monitoring by Distributed Fiber Optic Sensors (DFOS) is selected for an in-depth description, main advantages, deployment possibilities in concrete bridges as surface-bonded or embedded in the concrete matrix variants, and field of application. Several practical applications in real-world structures and bridges are also described, showing the excellent performance of this technique for an accurate BM. The focus is also in the image-based data collection, in particular on the Digital Image Correlation (DIC) technique and remote sensing by satelite-based InSAR (Interferometric Synthetic Aperture Radar). The importance of Data Fusion (DT) of data streams coming from different sensing techniques for a better decision-making based on the results of the monitoring is also emphasized, by presenting a successful application of combined DFOS+DIC+AE (Acoustic Emission) to characterize complex resisting mechanisms in structural concrete. Finally, damage detection in bridges under the challenging effects of operational (traffic) and environmental (temperature) variability is considered and an un-supervised methodology for damage detection and location by using only monitored acceleration data is derived. The cases with ambient vibration and forced vibration by traffic and with and without environmental changes are differentiated and appropriate damage features proposed. The application to real bridges is presented, showing the correct performance in damage detection in real-world scenarios as presented in the 3 case studies of bridges where acceleration records in un-damaged and damaged conditions are available. The damaged state is only used to check the correct performance of the un-supervised damage detection methodology.

Biography

Joan Casas, is a professor of bridge engineering and structural management at the School of Civil Engineering of the Technical University of Catalonia in Barcelona.

Master (1984) and Ph.D.(1988) degrees from Technical University of Catalonia. Main expertise related to bridge design and management, specially focusing on safety assessment and structural health monitoring of existing bridges.

Author or co-author of 39 books and chapters of books, 200 papers in refereed technical journals and over 400 conference proceedings.

Among other editorial boards, he is Managing editor of the journal Structure and Infrastructure Engineering, Associate editor of the Journal of Bridge Engineering from ASCE, Specialty Chief Editor of Frontiers in the Built Environment, Bridge Section. He serves as editorial Board member of the Journal of Infrastructure Preservation and Resilience and as Guest editor of the special issue of journal Structures on “Design, Construction, and Smart Management from Long- to Super-Long-Span Bridge Structures”

He has received several awards, including the Bill Curtin Medal from the Institution of Civil Engineers from UK to the best paper describing innovative design in civil engineering, the IABMAS-Senior Prize in recognition of outstanding contributions to the application of advanced bridge inspection, assessment and monitoring techniques and the T.Y. Lin medal in recognition of outstanding contributions to bridge engineering. Recently, he received the fib Fellow Award 2025, awarded by the International Association of Structural Concrete

Founder member and Secretary General of IABMAS (International Association for Bridge Maintenance and Safety) since 1999 and Chair of IABMAS conferences in Barcelona in years 2002 and 2022. He has been keynote speaker at several conferences organized by the Chinese National Group of IABMAS.

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