香港理工大学徐幼麟教授学术报告

报告题目：SHM-Based Fatigue Damage Prognosis for Long-Span Cable-Supported Bridges under Multiple Dynamic Loadings

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报告简介： Many innovative long-span cable-supported steel bridges have been built around the world. When these bridges are constructed in wind-prone regions, they suffer considerable buffeting-induced vibration. The frequent occurrence of such a buffeting response at relatively large amplitude may cause fatigue damage to steel members and their connections. Long-span bridges also carry highway and/or railway loadings, and these dynamic loadings affect the fatigue life of the bridge as well. The fatigue damage prognosis (FDP) of bridges under multiple fatigue loadings is therefore necessary for bridge safety, maintenance and management. However, it is a challenging task due to the complexity of structural systems, randomness in fatigue loadings and complicated mechanisms of fatigue damage. In recent years, long-term structural health monitoring (SHM) systems have been developed to measure dynamic loadings and structural responses of long-span bridges, and to assess their functionality and safety while tracking the symptoms of operational incidents and potential damage. SHM technology provides a promising means of tackling challenging FDP issues. However, current research on the SHM and FDP of long-span bridges is not interconnected.

This presentation will propose an SHM-based FDP framework for long-span bridges under combined traffic and wind loadings. It involves five major tasks: (1) integrate multiscale finite element modeling and model updating with stress analysis for predicting both global and local structural responses of long-span bridges under combined traffic and wind loadings; (2) determine the optimal placement of multi-type sensors for the best global and local response reconstruction of the bridge through the input of measured responses from the SHM system; (3) assess the current health status of the bridge based on the previous loading histories and using the SHM-based damage detection method; (4) develop loading models based on incessant field measurement data from the SHM system so that the previous loading histories can be analyzed and future loadings can be forecast; and (5) conduct fatigue damage prognosis and predict the remaining fatigue life of the bridge. Although not all the five tasks have been completed yet in a systematic way, some relevant works which have been done at The Hong Kong Polytechnic University are presented with reference to the Tsing Ma suspension bridge in Hong Kong.

报告人简介： Professor Xu You-Lin is Dean of the Faculty of Construction and Environment and Chair Professor of Structural Engineering at The Hong Kong Polytechnic University. He was Head of the Department of Civil and Environmental Engineering from 2007 to 2013. He received his PhD from the University of Sydney in Australia. Professor Xu has conducted researches and served as a consultant in structural engineering for over three decades, with special interests in wind effects on long-span bridges and tall buildings, structural health monitoring of mega infrastructure, structural vibration control and smart structures. He has published over 240 SCI journal papers, delivered over 90 keynote or invited lectures at international conferences/ symposiums/ workshops.

Professor Xu also served in various capacities for relevant international associations and international journals. He is on the Civil Engineering list of the Most Cited Researchers developed for Shanghai Ranking's Global Ranking of Academic Subjects 2016 by Elsevier. In recognition of his outstanding research achievements, he received several prestigious awards, including the ASCE Robert H. Scanlan Medal in 2012, the Qian Ling Xi Computational Mechanics Award in 2010 and Croucher Award in 2006. Professor Xu has written three books, they are: Structural Health Monitoring of Long-Span Suspension Bridges, Wind Effects on Cable-Supported Bridges and Smart Civil Structures published by Spon Press (Taylor & Francis), John Wiley & Sons, and CRC Press (Taylor & Francis) respectively. He has been engaged in many high-impact knowledge-transfer projects, including the health monitoring projects on the Tsing Ma Bridge and the Stonecutters Bridge in Hong Kong, the CCTV Tower in Beijing and the Shanghai Tower in Shanghai. He is a Fellow of The Hong Kong Institution of Engineers, the American Society of Civil Engineers, the Engineering Mechanics Institute of the U.S.A., and the Institution of Structural Engineers of the U.K.

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