

**UNIVERSITY OF MACAU  
FACULTY OF SCIENCE AND TECHNOLOGY  
DEPARTMENT of CIVIL & ENVIRONMENTAL  
ENGINEERING**

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**"Pseudo-Excitation Method and its  
Applications in Civil Engineering"**

by

**Prof. J. H. Lin**

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**Date: 21 January 2011 (Friday)**

**Time: 3:30pm - 4:30pm**

**Venue: WLG103, University of Macau**

**Abstract**

*In the design of long-span bridges, the spatial effects of earthquakes, including the wave passage effect, the incoherence effect, and the local site effect, must be taken into account. The random vibration method can fully account for the statistical nature as well as the spatial effects of earthquakes, and so has been widely regarded as a very promising method. Unfortunately the very low computational efficiency has become the bottle-neck for its practical use, even though a number of scholars have made great endeavors to improve the efficiency. In the past 30 years, a research group at Dalian University of Technology, led by Prof. J.H. LIN, has originated and developed an efficient method, known as the pseudo-excitation method (PEM), to cope with the above computational difficulty. The PEM is accurate because the correlation terms between all participating modes and between all excitations have both been included. It is also very easy to use because the stationary random vibration analysis is transformed into harmonic vibration analyses, while the non-stationary random vibration analysis is transformed into deterministic transient dynamic analyses. The most important advantage of PEM is its extremely high efficiency. For an average 3D FEM based bridge model, the computing time for stationary seismic analysis is only a few minutes when using an ordinary personal computer. Therefore this method can easily compute the 3D random seismic responses of long-span bridges based on finite element models with up to thousands of degrees of freedom efficiently and accurately. This method has been widely applied in China in civil and transportation engineering (cars and high speed trains). The recently published official document "Guidelines for Seismic Design of Highway Bridges JTG/T B01-01-2008" recommends the PEM as a basic tool for seismic analysis of long-span bridges. The method is also introduced by a whole chapter in the "Vibration and Shock Handbook" published by CRC Press (US) in 2005. Owing to its extensive applications, the PEM has now become an important part of the random vibration courses in some Chinese universities and colleges. This report will be presented by Prof. J.H. Lin to show the applications of PEM in different engineering areas.*

**Biography**

*Prof. J. H. Lin was born in Shanghai in 1941. He studied in the Department of Modern Mechanics at the University of Science and Technology of China (USTC) from 1959 to 1964, and then studied as a postgraduate in Dalian University of Technology (DUT) from 1964 to 1967. His research results in structural nonlinear seismic analysis and dynamic optimization published nearly 30 years ago were widely cited and applied in civil and mechanical engineering. After studying as a visiting fellow at Princeton University in Aug.1980—Oct.1981, Prof. Lin has spent more than 20 years to establish the “pseudo excitation method”, an efficient series of algorithms for structural random vibration computations, which has been used efficiently in many important engineering projects in China. Hundreds of papers cited this method in solving engineering problems in different fields have been published by many professors and experts.*

**ALL ARE WELCOME!**