



香港理工大學, 土木及環境工程學系

**THE HONG KONG POLYTECHNIC UNIVERSITY**

Department of Civil and Environmental Engineering



香港  
鋼結構學會

Hong Kong Institute of  
Steel Construction

## **HALF-DAY SEMINAR**

### **Periodic Metamaterials for Seismic Base Isolators of Engineering Structures**

by Professor Y.L. Mo

John and Rebecca Moores Professor at the Civil and Environmental Engineering Department,  
University of Houston (UH), Houston, Texas, USA

Organized by

Hong Kong Institute of Steel Construction [www.hkisc.org](http://www.hkisc.org)

Department of Civil and Environmental Engineering, The Hong Kong Polytechnic University

Supported by

Structural Division, The Hong Kong Institution of Engineers

Time and Date: 8:45am for 9:00am to 12:00 noon, 17 June, 2019 Venue: Y305, The Hong Kong Polytechnic University, Hungghom, Kowloon
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#### **Abstract**

Engineering structures are very critical to sustainable economy. Hence, structures located in seismic regions are required to have seismic design. Seismic isolation systems for engineering structures currently under development employ high-damping rubber bearings, lead rubber bearings, or friction pendulum bearings. These systems are effective in reducing the damaging effects of the horizontal components of an earthquake, but they are not well suited for protection against the vertical components of seismic loads. Current seismic isolation systems also cause large relative horizontal displacement between the foundation and the supported structure, which occurs during a seismic event, further complicating the design. A gap, sometimes called a moat, is usually provided between the isolated structure and the surrounding non-isolated structures to avoid hammering. The need for a moat, however, requires very careful design detail to avoid any rigid connection between the isolated and non-isolated portions of the structure throughout its lifetime. A design that eliminates the need for such design restrictions would be very attractive.

This lecture will present an attempt to overcome the disadvantages existing in current seismic isolation systems by developing innovative periodic metamaterial-based seismic base isolators. These periodic metamaterial-based seismic base isolators, in effect, use the foundation of the structure as the base isolation

system. The foundation is made of a new material, called periodic metamaterial, which can block, or reflect, the damaging seismic motion being transmitted to the structure. Both the analytical and experimental studies have performed to demonstrate the feasibility and effectiveness of the proposed periodic metamaterial-based seismic base isolators. Guided by solid state physics, the periodic metamaterial-based seismic base isolators can be made by the periodic metamaterial to exhibit special characteristics that are useful in resisting the loads imposed on structures from earthquakes. Possessing distinct frequency band gaps, this periodic metamaterial will block, or reflect, the incoming seismic motion with the frequencies falling between these gaps. The frequency band gaps in the x, y, and z directions can be controlled by their design and manufacturing, exactly what is needed for periodic metamaterial-based seismic base isolators. One can properly design the frequency band gaps to match the fundamental frequency of the structure, so that its dynamic response will not be amplified; alternatively, one can design the frequency band gaps to match the strong energy frequency components of the design earthquake. Periodic metamaterial-based seismic base isolators have been proposed for engineering structures to mitigate the potential damage caused by the earthquake and to increase the safety margin of the engineering structures. Also, periodic metamaterial-based seismic base isolators can enhance the design of standard engineering structures, which can be licensed and built at lower costs.

### **Biography**

Dr. Y.L. Mo, F.ASCE, F.ACI and F.Humboldt, is John and Rebecca Moores Professor at the Civil and Environmental Engineering Department, University of Houston (UH), Houston, Texas. He is also Tsinghua Chair Professor, Institute of Future City and Infrastructure, Tsinghua University, Beijing, China. Dr. Mo's technical interests are multi-resolution analytical simulations, network analysis, large-scale concrete structure testing and field investigations of the response of structural systems, on which he has more than 400 research publications, including 209 refereed journal papers, many conference, keynote and prestige lectures, research reports, books and book chapters, magazine articles and earthquake field mission reports. Dr. Mo has successfully supervised six post-doc, 25 PhD and over 46 Masters Theses as well as 31 visiting scholar studies. It is also worth noting that with the novel idea presented in this seminar Dr. Mo and his PhD students have obtained two U.S. patents on vibration isolation of structural systems.

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### **Fees & Registration**

The registration fee includes a copy of lecture note

Regular Registration:       **HK\$ 500** each for HKISC/ HKIE Members; **HK\$ 600** each for non HKISC/ HKIE Members.

Group Registration:       **HK\$ 500** each for group registration of at least 5 people

### **CPD Certificates**

This seminar is recommended for **HALF** CPD day. An attendance certificate will be issued.

Please send the completed registration form with registration fee to **Mr. Sam Chan**, The Hong Kong Institute of Steel Construction, ZN912, Department of Civil and Environmental Engineering, The Hong Kong Polytechnic University, Hung Hom, Kowloon by **5<sup>th</sup> June 2019** (Tel: 852-2766 6051, Fax No.: 852-2334 6389). You can download this form on HKISC web (<http://www.hkisc.org>). For technical information, please contact Professor S.L. Chan at 2766 6047.

**Half-day seminar**  
**Periodic Metamaterials for Seismic Base Isolators of Engineering Structures**  
**REGISTRATION FORM**

*(To be replied on or before 5<sup>th</sup> June 2019)*

Please follow the 2 steps registration procedure:

1. Fax the completed registration form to Mr. Tommy Li for preliminary registration.
2. Post the completed registration form together with a crossed cheque payable to **Hong Kong Institute of Steel Construction Limited**, Mr. Tommy Li, The Hong Kong Institute of Steel Construction, c/o ZN912, Department of Civil and Environmental Engineering, The Hong Kong Polytechnic University, Hunghom, Kowloon, Hong Kong. on or before 5<sup>th</sup> June 2019

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**To: Mr. Tommy Li, HKISC**

**Fax: 852- 2334 6389**

**A. Personal Details:**

Title	Name in full	Name of Company	Tel.	E-mail address
1.				
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**B. Registration Details:**

Item	Registration Fee	Total no. of registration	Sub-total
1. Regular registration (Member*price)	HK\$ 500 each x	_____ person(s)	= HK\$ _____
2. Regular registration (Non-member*price)	HK\$ 600 each x	_____ person(s)	= HK\$ _____
3. Group registration (at least <u>5</u> people)	HK\$ 500 each x	_____ person(s)	= HK\$ _____
<b>Total amount:</b>			<b>HK\$</b>

*Note: The registration fee includes a copy of proceedings, a copy of CPD certificate and tea refreshment*

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I enclosed a crossed cheque (cheque no. \_\_\_\_\_ ) with the sum of HK\$ \_\_\_\_\_ for \_\_\_\_\_ the registration fee of the captioned Seminar.

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

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Yes, I/ we would like to have CPD certificate(s).  Not request for certificate(s).

Should you have further query, please do not hesitate to contact Mr. Sam CHAN at [samchan@hkisc.org](mailto:samchan@hkisc.org).