UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

DREMES

The Dynamic Research Enterprise for Multidisciplinary Engineering Sciences
ZJU-UIUC Joint Research Center

ZHEJIANG UNIVERSITY

Center for Infrastructure Resilience in Cities as Livable Environments
CIRCLE

CIRCLE
Distinguished Lecture Series

Dr. Xinzheng Lu

City-scale disaster simulation and resilience assessment: From physics-based to AI methods

ABSTRACT: "Resilient city" and "smart city" have emerged as the development directions of urban disaster prevention. As a result, it's critical to use physics-based models to investigate the mechanisms of urban disaster and resilience evolution, as well as to continue developing AI-driven urban disaster simulation and resilience assessment methods.
This presentation will first introduce the nonlinear time history analysis at the building and city scales against earthquake disasters. The lecturer will then present a physics-based multi-hazard simulation framework based on the city information model (CIM) to assess the resilience of the community in the face of multiple hazards (i.e., earthquake, fire, wind, and COVID-19 disasters). Because the developed physics-based models do not rely entirely on historical disaster data, they can be applied to a wide range of communities. The database, which is powered by CIM, standardizes the data format required by simulations for various hazards and scales, improving simulation efficiency. Furthermore, the potential of AI in providing a competitive advantage over traditional disaster simulation methods is investigated. AI-driven urban disaster simulation and assessment methods, in particular, are being developed to facilitate intelligent data acquisition, model establishment, vibration identification, and damage prediction. The proposed AI models can significantly improve modeling and computing efficiencies by learning and illustrating characteristics of the disaster evolution process

BIO: Prof. Lu got his BS and Ph.D. degrees from Tsinghua University of China. Now he is a full professor and the Head of the Institute of Disaster Prevention and Mitigation of the Department of Civil Engineering at Tsinghua University. He is also the Editor-in-Chief of Engineering Mechanics journal of China Society of Theoretical and Applied Mechanics, Associate Editor of Journal of Structural Engineering-ASCE, and a member of the editorial boards of Earthquake Engineering & Structural Dynamics and Journal of Earthquake Engineering. Prof. Lu's major research interests cover disaster prevention and mitigation of civil engineering. He has been listed as one of the "most cited Chinese researchers from 2014-2021" by Elsevier. Many of his research findings have been adopted by ACI guidelines, Chinese national and industrial design codes, important simulation platforms such as OpenSees and US-NSF NHERI SimCenter, and landmark buildings such as CITIC Tower (528 m), Beijing. He has received several important awards, including the Second Class National Natural Science Award, the First-Class Natural Science Award of the Ministry of Education of China, the Distinguished Professor of the Chang Jiang Scholars Program of the Ministry of Education of China, the XPLORER PRIZE of the Tencent Foundation, and the Excellent Young Scientist Fund of the National Natural Science Foundation of China.

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杰 出 讲 座 系 列

陆新征教授

城市尺度灾害模拟和韧性评估：从物理方法到AI方法

摘要：“韧性城市”和“智慧城市”已成为城市防灾的发展方向，因此，基于物理驱动模型深入研究城市灾害与韧性演化机制，并结合先进AI算法发展智能化城市灾害模拟与韧性评估方法具有重要意义。首先，将介绍基于非线性动力时程分析的建筑抗震弹塑性分析和城市抗震弹塑性分析方法；然后，提出基于CIM与物理驱动模型的城市灾害模拟与韧性评估方法，包括基于CIM和物理模型的多尺度多灾害模拟框架，复杂城区地震、风灾、火灾情境模拟，新冠肺炎临时医院排风的环境影响快速模拟。最后，分别从数据获取、模型构建、振动识别、震损预测等方面，提出AI驱动的城市灾害模拟与评估方法。AI模型可以学习和表达灾变演化过程的复杂特征，并显著提升分析效率。

简介：陆新征，于清华大学获学士学位与博士学位，现为清华大学土木工程系教授，防灾减灾工程研究所所长。兼任《工程力学》期刊主编，Journal of Structural Engineering–ASCE Associate Editor，Earthquake Engineering & Structural Dynamics, Journal of Earthquake Engineering 编委等。主要从事土木工程防灾减灾方面的研究工作。连续入选Elsevier“中国高被引学者”（2014–2021）。成果被国标、行标、美国混凝土学会规程、美国NSF重大项目平台SimCenter及重要结构计算软件OpenSees采纳，并应用于北京“中国尊”超高层建筑等多个标志性工程。获国家自然科学二等奖(2/4)、教育部自然科学一等奖（1/5）、教育部“长江学者奖励计划”特聘教授（2018）、腾讯科学探索奖、国家自然科学基金优秀青年基金（2012）等奖励。

CIRCLE：宜居城市基础设施韧性中心是伊利诺伊大学厄巴纳–香槟分校（UIUC）格兰杰工程学院和浙江大学（ZJU）建立的三个联合研究中心之一。 CIRCLE 杰出讲座系列旨在为教师和学生提供与该领域国际知名专家会面和互动的机会。

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2022年05月25日 zoom | 北京时间：晚上9点

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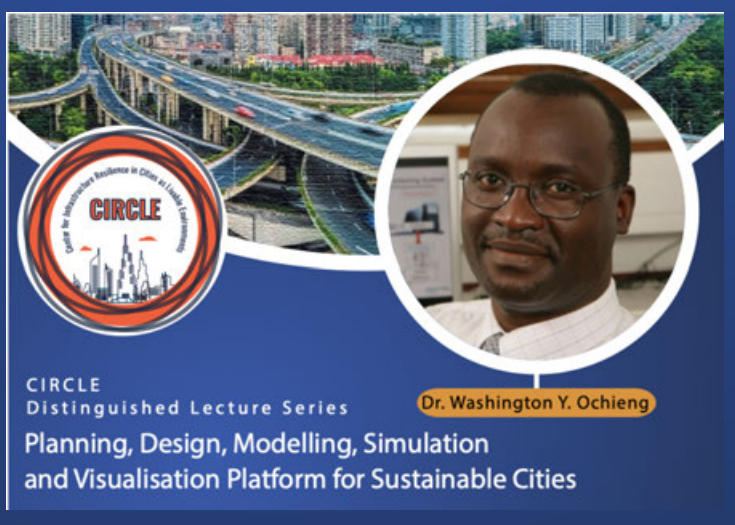

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