

Performance-Based Multi Hazard Design (PB-MH-D) of Civil Engineering Structures

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Abstract: As a follow-up to the events at the dawn of the new millennium related to Multi - Hazard (MH) scenarios striking on structures and infrastructures (e.g., 2005 hurricane Katrina or 2011 Tohoku earthquake in Japan), the need for approaches accounting for MH exposures in the design of civil engineering structures has been clearly recognised by the scientific community, and, thanks to a worldwide policy for infrastructural management which supports the actions of the Sendai Framework for Disaster Risk Reduction 2015-30, political efforts are ongoing in this direction. Despite this evidence, a methodology for the true MH design of structures who allows the performance evaluation under different threats in a coherent and uniform manner is still not available. Current structural design methods tend to design the structures for ultimate limit states (ULSs) and serviceability limit states (SLSs) performances under the hazard that is supposed to be dominant for the specific LS, and then check the performances under other hazards separately, with the purpose of updating the design if required. This way of approaching the design cannot be considered a MH one, but rather a hazard-by-hazard approach, and it leads to a final solution which is not a global optimum (i.e., eligible as the best design configuration by considering both SLSs and ULSs for all the acting hazards), but it is rather a local one (mostly driven by one hazard and judged as acceptable for other hazards).

In this seminar, I will first provide an overview of the issues arising when the design of civil engineering structures is approached by a true MH point of view. I will then discuss, with the aid of illustrative numerical results, a framework to manage the above-mentioned issues for the design case of buildings under earthquake and winds and under the chained events of earthquake followed by explosions or fire. Design implications and open challenges are highlighted, with the goal of driving the design practice toward a new, efficient, globally optimal, and sustainable approach/philosophy which considers the MH scenarios, which will be more and more frequent in upcoming years, also due to the climate change.

Bio: Dr. Francesco Petrini is Associate Professor in Structural Design in the Department of Structural and Geotechnical Engineering at Sapienza University of Rome, where he is spearheading research on Multi-Hazard Design of Structures and vibration Energy Harvesting for Smart Structures design. He holds a Laurea degree (Bachelor+MSc) and a PhD, both in Structural Engineering from Sapienza University of Rome, with research periods abroad in National Technical University of Athens and Louisiana State as visiting postdoctoral researcher, and in City, University of London as a senior postdoctoral researcher. Dr Petrini research interests lie in the areas of stochastic dynamics, structural vibrations control, offshore wind turbines, and structural wind, earthquake, blast and fire engineering.

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(in-person)

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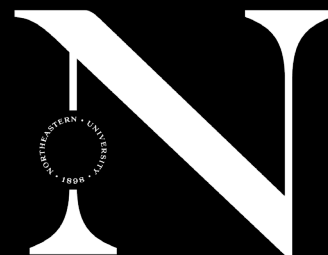


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