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Carbon nanofiber aggregate sensors for sustaining resilience of nuclear power plants to multi-hazards

Multi-hazards such as natural hazards (floods, earthquakes, severe storms and wildland fires) or manmade disasters (nuclear disaster, oil spills, and terrorist attacks) lead to substantial damage on critical infrastructures and communities and have social, economic and environmental consequences. The immediate impacts on multi-hazards include loss of human life and damage to infrastructures. Multi-hazard mitigation for nuclear power plants forms a vital input in disaster management, the design of development strategies and emergency response forecasting. In this lecture, we will present how to develop a robust and cost-effective real-time carbon nanofiber aggregate (CNFA) sensor system that can be embedded at nuclear power plants for damage detection during events such as earthquakes, nuclear disasters, and missile attacks, and for water level monitoring in nuclear power plants during flooding. A real-time multi-hazard alert software system will also be developed to monitor the data generated by the CNFA sensors and produce proper alerts when hazardous events are detected. The CNFA acts as a strain sensor. The stresses in the critical regions of nuclear power plants due to natural or man-made hazards can be determined by taking into account the strains developed on the surface of the CNFA. This strain produces an equivalent stress in the CNFA that can be derived from its electrical resistance variation. The CNFA sensor system determines the stresses and strains in nuclear power plants and transmits the information to immediately provide real-time information to decision makers. We will also develop a predictive computational modeling platform, which incorporates various couplings between mechanical, electrical and thermal effects and provides an accurate coupled response (e.g., displacements, stresses, temperature, electrical fields) of nuclear power plants.

Biography

Dr. Y L Mo, F.ASCE, F.ACI, F.Humboldt is Professor at the Civil and Environmental Engineering Department, the University of Houston (UH). He is also Tsinghua Chair Professor, Institute of Future City and Infrastructure, Tsinghua University, Beijing, China. His technical interests are multi-resolution distributed analytical simulations, large-scale concrete structure testing and field investigations of the response of complex structures, on which he has more than 400 research publications, including 201 refereed journal papers, many conference, keynote and prestige lectures, research reports, books and book chapters, magazine articles and earthquake field mission reports. In the past several years, he has focused on energy material research, especially the application of carbon nanofiber material for sustaining resilience of nuclear power plants to multi-hazards.

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