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Satellite-based big data for resilience of critical infrastructures subjected to natural and man-made disasters

The potential impacts of natural and man-made disasters, such as earthquakes, tornados, tsunamis, blasting, missile attacks, increase significantly to critical infrastructures. The resilience of such infrastructures is highly desired to reduce the economic loss to a minimum. Space borne satellites acquiring information on the earth surface routinely will provide rich data. Combining together with the finite element analysis results for the targeted critical infrastructures will produce large and complex data sets including analysis, capture, data duration, search, sharing, storage, transfer, visualization, and information privacy that can be stored in big data. The critical infrastructures can be visualized as assemblies of various elements. The behavior of a whole structure can be predicted if the behavior of each element is thoroughly understood. As part of this lecture, the development of a finite element analysis (FEA) program to predict the nonlinear behavior of infrastructures will be presented. In the formulation, we develop the constitutive relation and various element modules with a model-based simulation approach by taking into account the Cyclic Softened Membrane Model developed at the University of Houston. To form a FEA program, the constitutive relation modules and the analysis procedure were implemented into a finite element program development framework, Open Sees developed at UC Berkeley. By analyzing the data collected by satellite after impact and the analytical outcomes of the targeted infrastructures, a resilience methodology can be quickly developed that will be very helpful for the decision makers.

Biography

Yi Lung Mo is a PhD and PE holder. He is a Professor of Civil Engineering and Director of Thomas TC Hsu Structural Laboratory at the University of Houston, Houston. He has done his PhD in Structural Engineering from University of Hannover, Germany. He has 5 awards and 2 pending patents and has written eight books and book chapters and has had 149 technical papers published in international journals, also 152 conference papers and 51 technical reports. Based on his research performance, he has received the Alexander von Humboldt Research Fellow Award from Germany, the Distinguished Research Award from the National Science Council of Taiwan.

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