International Workshop on Advanced Earthquake Engineering Testing and Simulation for Near-Fault Ground Motions, Nov. 19-20, 2015
近斷層地震工程實驗技術及模擬國際研討會

The Challenge of Near-Fault Ground Motions to Seismic Isolated Structures

Lyan-Ywan Lu
Professor
Department of Civil Engineering, National Cheng Kung University
lylu@mail.ncku.edu.tw

Abstract

Since a near-fault (NF) ground motion is usually characterized by an intense long-period velocity pulse wave and a high level of peak ground acceleration, the frequency contents of a NF ground motion can be very different from a regular earthquake and its intensity can be difficult to be precisely predicted. On the other hand, a seismic isolated structural system is usually a flexible and long-period system; therefore although the isolation system may effectively mitigate the structural responses in a regular earthquake, its response may be significantly amplified in a NF ground motion. In this presentation, the hazardous effects of NF ground motions on a seismic isolated structure will be discussed. The primary causes of these effects, including resonant-like behavior and nonlinear softening property that exhibits in most isolation systems, will be explained.

Furthermore, in order to alleviate the hazardous effects induced by NF ground motions, the research opportunity for developing more advanced isolation systems, such as isolators with variable mechanical property, will be addressed. Seismic isolators with variable property, which are also named adaptive isolators or multi-functional isolators, can be carried out in various ways, for instance, isolators with variable stiffness or variable damping. In this presentation, the advantages of using sliding isolators with variable curvature (SIVC) whose isolation stiffness varies with the isolator displacement will be demonstrated. Due to the variable stiffness, an isolation system with SIVCs is able to prevent the shortcomings of the softening property and the resonant-like behavior that a conventional isolation system may encounter in a NF earthquake.