Power Optimization of the Hybrid Test in Earthquake Engineering

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This thesis considers a new testing method, called the real time hybrid test, in which the force actuators, shaking table and computer model for seismic simulation are used at the same time. In this experience, with the help of substructuring techniques, the mentioned structure is divided into one or more experimental and analytical substructures. The experimental substructure is chosen from the parts of the structure with their behavior being difficult to be predicted or simulated in computer. The interface forces between the physical and numerical substructures are imposed by actuators and the resulting displacements and velocities are fed back to the computer. In this study, after describing the hybrid test and presenting numerical integration algorithms associated with hybrid simulation, three different procedures for dividing ground motion between the actuator and the shaking table are discussed. This is shown that a minimized testing power is attained using the dynamic optimization method in which the share of each apparatus changes with time according to an equation developed with the use of derivation of power equation.

Keywords: Hybrid test, shake table, optimization, substructure, actuator.