

Modal Approach for Decoupling Damage Cost Dependencies in Building Stories

Authors : Haj Najafi Leila, Tehranizadeh Mohsen

Abstract : Dependencies between diverse factors involved in probabilistic seismic loss evaluation are recognized to be an imperative issue in acquiring accurate loss estimates. Dependencies among component damage costs could be taken into account considering two partial distinct states of independent or perfectly-dependent for component damage states; however, in our best knowledge, there is no available procedure to take account of loss dependencies in story level. This paper attempts to present a method called "modal cost superposition method" for decoupling story damage costs subjected to earthquake ground motions dealt with closed form differential equations between damage cost and engineering demand parameters which should be solved in complex system considering all stories' cost equations by the means of the introduced "substituted matrixes of mass and stiffness". Costs are treated as probabilistic variables with definite statistic factors of median and standard deviation amounts and a presumed probability distribution. To supplement the proposed procedure and also to display straightforwardness of its application, one benchmark study has been conducted. Acceptable compatibility has been proven for the estimated damage costs evaluated by the new proposed modal and also frequently used stochastic approaches for entire building; however, in story level, insufficiency of employing modification factor for incorporating occurrence probability dependencies between stories has been revealed due to discrepant amounts of dependency between damage costs of different stories. Also, more dependency contribution in occurrence probability of loss could be concluded regarding more compatibility of loss results in higher stories than the lower ones, whereas reduction in incorporation portion of cost modes provides acceptable level of accuracy and gets away from time consuming calculations including some limited number of cost modes in high mode situation.

Keywords : dependency, story-cost, cost modes, engineering demand parameter

Conference Title : ICAICE 2017 : International Conference on Advanced Interdisciplinary Civil Engineering

Conference Location : New York, United States

Conference Dates : October 05-06, 2017