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DEVELOPMENT OF SEISMIC FRAGILITY SURFACES BASED ON COUPLED SEISMIC SOURCE-PATH-SOIL-STRUCTURE SYSTEMS

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The effects of dependence of damage probability distribution on seismic source, wave path and site conditions are studied. The fragility curves with are generally developed a single parameter of ground motion to relate the level of shaking to the expected structural damage. However, a single parameter of ground motion cannot completely characterize complex loading to a structure. The main goal of this work is to use parameters of seismic source, wave path and site condition to characterize the role of the most influential effects on the induced damage in the structure through numerical calculations. The seismic source, wave path, site and structure are coupled to a system to characterize complex effects on the structure from the earthquake source to damage of building. The developed methodology is based on the use of structural elements with nonlinear behaviour of damage mechanics and plasticity. The damage level of a typical reinforced concrete structure is evaluated by use of nonlinear numerical calculations. The effects of seismic source characteristics, wave path and site condition on the seismic response and damage probability distributions are analysed. A representation damage distribution probability surfaces (fragility surfaces) is developed to characterize the effects of seismic source, wave path and site condition. Multi-variable fragility surfaces are built as function of magnitude, epicentral distance and site condition rather than single ground motion. It is apparent that there are wide differences in damage distribution depending on the seismic source, wave path and site condition. It seems likely that the increased magnitude leads to a marked increase in exceeding probability for different damage states. The intensity of building damage is greatest in the vicinity of the causative fault and attenuate with distance from fault. It is apparent that there are wide differences in damage distribution depending on the site conditions. The seismic fragility surfaces characterized by magnitude, distance and site condition can be used for near real time earthquake damage estimation.

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