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Practice-ready conditional hazard and design earthquakes' maps

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ABSTRACT

Vector-valued ground motion intensity measures (IMs) have been the focus of a significant deal of research recently. Proposed measures are mainly function of spectral ordinates which have been shown to be useful in the assessment of structural response. In a pair of IMs, it is often the case one is considered of primary importance with respect to the other. For example, it is generally believed that integral ground motion IMs, associated with duration, are less important with respect to the peak parameters of the record; nevertheless, there may be cases in which the cumulative damage potential of the earthquake is also of concern. For these IMs, it seems appropriate to develop conditional hazard maps; i.e., maps of percentiles of a secondary IM given the occurrence or exceedance of a primary parameter, for which a design hazard map is often already available. In the presented study, this concept is illustrated and conditional hazard is developed for a parameter which may account for the cumulative damage potential of ground motion, the so-called *Cosenza and Manfredi index* (ID), given peak ground acceleration (PGA). The study shows how easily it is possible to obtain analytical distributions of ID conditional on PGA and on the corresponding design earthquake in terms of magnitude and distance from hazard disaggregation, the mapping of which also seems useful and feasible in those countries where probabilistic hazard is available. As shown by the application to the Campania region (southern Italy), maps conditional on the code design values of PGA may be used for a more refined and consistent definition of design seismic actions on structures (e.g., ground motion record selection for nonlinear dynamic analysis). The conditional hazard approach may be applied, in principle, to any other vector of IMs, providing the advantages of vector-valued hazard with much less effort, and therefore rendering it ready for code implementation.