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IMPLEMENTING INCREMENTAL DYNAMIC ANALYSIS FOR MEASURING ENTROPY-BASED SUFFICIENCY OF AN INTENSITY MEASURE

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Seismic risk in the context of performance-based earthquake engineering can be represented in terms of the mean annual rate of exceeding a prescribed performance level. In such context, a record- and structure-specific scalar parameter or a low-dimensional vector of parameters known as the ground motion Intensity Measure (*IM*) is usually adopted to play the interface variable between seismic demand and hazard. The selection of a suitable *IM* for representing ground motion uncertainty has been the focus of various research endeavours during the past decade. Sufficiency is one of the two main properties that is widely considered for measuring the suitability of an IM in representing the dominant features of ground shaking. A sufficient *IM*, which is one that renders the estimation of demand for various intensity levels independent of all other ground motion parameters (Luco & Cornell, 2007), waives the requirement of careful hazard-specific ground-motion record selection.

Given that establishing sufficiency is by no means a trivial task, the alternative Relative Sufficiency Measure (RSM), has been proposed (Jalayer et al., 2012; Ebrahimian et al., 2015) based on the Shannon entropy (Shannon, 1948) concept in information theory. The RSM can be employed for quantifying the relative sufficiency of an *IM* with respect to another benchmark *IM* in terms of the amount of extra information that it relays on average about the ground motion for the estimation of the engineering demand parameter of interest. This paper demonstrates how Incremental Dynamic Analysis (IDA), as a widely-used non-linear analysis procedure, can be implemented for estimating the RSM. The methodology is applied to a bi-dimensional MDOF frame of an existing older RC building which is modelled considering the mutual interactions between flexural, shear and axial forces and rigid-end (due to bar-slip) deformations. Several alternative *IM*'s are compared and ranked in terms of their relative sufficiency with respect to the first-mode spectral acceleration.

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