

## A Three Elements Vector Valued Structure's Ultimate Strength-Strong Motion-Intensity Measure

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**Abstract :** This article presents an alternative collapse capacity intensity measure in the three elements form which is influenced by the spectral ordinates at periods longer than that of the first mode period at near and far source sites. A parameter, denoted by  $\beta$ , is defined by which the spectral ordinate effects, up to the effective period ( $2T_1$ ), on the intensity measure are taken into account. The methodology permits to meet the hazard-levelled target extreme event in the probabilistic and deterministic forms. A MATLAB code is developed involving OpenSees to calculate the collapse capacities of the 8 archetype RC structures having 2 to 20 stories for regression process. The incremental dynamic analysis (IDA) method is used to calculate the structure's collapse values accounting for the element stiffness and strength deterioration. The general near field set presented by FEMA is used in a series of performing nonlinear analyses. 8 linear relationships are developed for the 8 structures leading to the correlation coefficient up to 0.93. A collapse capacity near field prediction equation is developed taking into account the results of regression processes obtained from the 8 structures. The proposed prediction equation is validated against a set of actual near field records leading to a good agreement. Implementation of the proposed equation to the four archetype RC structures demonstrated different collapse capacities at near field site compared to those of FEMA. The reasons of differences are believed to be due to accounting for the spectral shape effects.

**Keywords :** collapse capacity, fragility analysis, spectral shape effects, IDA method

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