



**INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS**

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Thesis Title: Global Damage Indices for RC Structures: A Numerical Response-Driven Training Approach

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SHORT ABSTRACT

Any seismic damage index model can be used to compute earthquake-induced structural damage of a building. Most researchers prefer combined damage index models (e.g., modified Park and Ang-type damage indices) due to their ability to consider the effect of both maximum and cyclic deformations on structural damage. All such combined damage models require section-level responses through nonlinear time-history analysis and cannot compute the global damage index (GDI) using global-level responses alone. Utilising the structural dynamic responses recorded by modern sensors, there is a scope for developing a new combined GDI evaluation method which uses such recorded data and avoids the requirement of numerically obtained sectional responses. On the other hand, the acceptability of the computed damage of a building utilising any damage index model through the output of a representative finite element model depends on the authenticity of the experimental data with which the finite element model is calibrated. The lateral output of any finite element model is usually calibrated with experimental results of axially loaded cantilever columns subjected to unidirectional horizontal quasi-static loading. For most of the conventional experimental setups, the true lateral behaviour of a cantilever column is altered because of the undesirable orientations of the actuators and the fixing arrangements between the actuator heads and the column tip. Therefore, the results obtained from such experiments must be rectified to generate true lateral load-deformation behaviour before being used directly for the calibration of any finite element model. Many previous research works also emphasised the need to rectify such experimental data. Therefore, a novel mechanics-based formulation to reproduce the true lateral load-deformation curve of cantilever columns from experimental data and a novel combined GDI evaluation method incorporating recorded floor-displacement responses for instrumented RC buildings during any seismic event are explored in the present study. Using the new GDI evaluation methodology, four different GDI formulae based on either displacement ductility or curvature ductility of columns are introduced to estimate the damage to 2D frames and 3D buildings. Explicit expressions of global damage coefficients available in those formulae are formulated in terms of some basic structural properties and local soil conditions. For wider applicability of the new GDI formulae, the limiting ranges of computed GDI values associated with post-earthquake restoration-based different global damage states (e.g., no damage, repairable, irreparable and collapse) are also studied.