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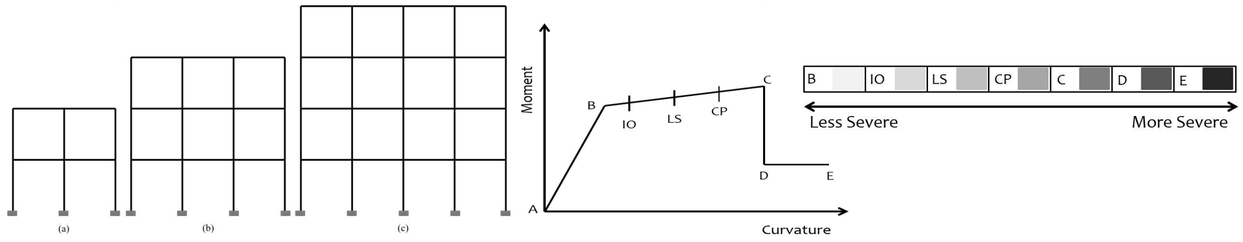
Quantification of Damage Using Hinge Pattern in Reinforced Concrete Moment Resisting Frame Buildings

ABSTRACTS

- Damage index models are used for quantification of damage in any numerical model of a building.
- While using any particular damage model there is high possibility that it might give similar result for two identical structures, each having different attributes.
- This study presents new method for quantification of damage for reinforced concrete moment resisting framed structures using the pattern of hinge formation in structure.
- As a primary step to estimate the damage from the pattern of hinge formation, it is necessary to understand and study the relation between damage and hinge pattern. For this purpose, energy-based damage index model is used.
- The relation between damage index and pattern of hinge formation is studied with the help of regression analysis.

NON-LINEAR STATIC ANALYSIS

- Under incremental cyclic loading various members in structure yields at different stages.
- Therefore, at global level the overall change in performance of structure is dominated by plastic yielding effects due to which structure experiences loss of strength and stiffness.



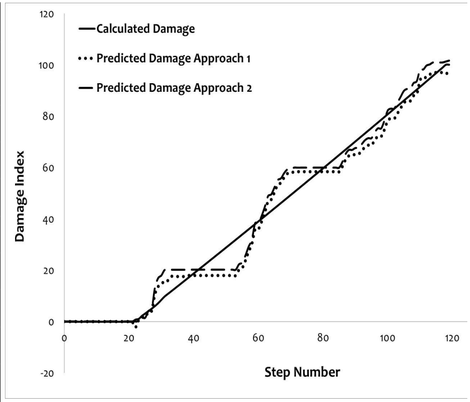
METHOD

- For the present study, an energy-based damage index is used which is useful to decide the damage state of structure based on deformation, during and after seismic event. This index helps to reveal the amount of damage to the structure and the margin left to reach the failure stage.
- For the prediction of damage from hinge pattern and hinge states, it is also necessary to understand and study the relation between damage and combination of various hinge pattern. This relation is attempted in this study with the help of regression analysis.

$$y = \beta_B x_B + \beta_{IO} x_{IO} + \beta_{LS} x_{LS} + \beta_{CP} x_{CP} + \beta_C x_C + \beta_D x_D + \beta_E x_E$$

RESULT

Status of Hinge	Approach 1	Approach 2	
	Weights (β values) Overall	Weights (β values) for Beams	Weights (β values) for Columns
B to IO	1.042	1.267	-0.507
IO to LS	2.781	2.786	2.406
LS to CP	4.357	4.323	4.318
CP to C	3.903	-	4.992
C to D	4.507	4.691	5.468
D to E	4.530	4.165	5.652
Beyond E	5.752	-	6.975
Constant	-7.241	-6.553	



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