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Optimal Seismic Design of Reinforced Concrete Shear Wall-Frame Structure

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Abstract : In this paper, the optimal seismic design of reinforced concrete shear wall-frame building structures was done using structural optimization. The optimal section sizes were generated through structural optimization based on linear static analysis conforming to American Concrete Institute building design code (ACI 318-14). An analytical procedure was followed to validate the accuracy of the proposed method by comparing stresses on structural members through output files of MATLAB and ETABS. In order to consider the difference of stresses in structural elements by ETABS and MATLAB, and to avoid over-stress members by ETABS, a stress constraint ratio of MATLAB to ETABS was modified and introduced for the most critical load combinations and structural members. Moreover, seismic design of the structure was done following the International Building Code (IBC 2012), American Concrete Institute Building Code (ACI 318-14) and American Society of Civil Engineering (ASCE 7-10) standards. Typical reinforcement requirements for the structural wall, beam and column were discussed and presented using ETABS structural analysis software. The placement and detailing of reinforcement of structural members were also explained and discussed. The outcomes of this study show that the modification of section sizes play a vital role in finding an optimal combination of practical section sizes. In contrast, the optimization problem with size constraints has a higher cost than that of without size constraints. Moreover, the comparison of optimization problem with that of ETABS program shown to be satisfactory and governed ACI 318-14 building design code criteria.

Keywords : structural optimization, seismic design, linear static analysis, etabs, matlab, rc shear wall-frame structures
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