# A strain monitoring approach for estimating lateral displacements of concrete columns under seismic excitations

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## Abstract

This study describes development of an indirect method for reference-free monitoring of lateral displacements in concrete columns under dynamic loads. The method is independent of the material and section properties of the structure. Therefore, damage due to the change in material and section properties during seismic events does not affect the estimated displacement results. The approach involves discretization of the column elements and placement of strain sensors on opposing sides of the columns for the computation of curvature during the seismic events. Element equivalent force vectors are obtained from the measured strains and subsequently employed for the computation of lateral displacements.


Fiber Bragg grating displacement sensors were employed for monitoring the strains. The experimental portion of the research involved shake table tests of a four-span bridge using the recorded ground motions of the 1994 Northridge earthquake. The objective was to verify the accuracy and efficiency of the proposed method by comparing the results with direct displacement measurements. Comparison of the proposed method with the direct measurement of the lateral displacements during the shake table tests indicated reasonable correlation between the computed and direct measurements.
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