

Seismic Response Control of 20-Storey Benchmark Building Using True Negative Stiffness Device

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Abstract : Seismic response control of structures is generally achieved by using control devices which either dissipate the input energy or modify the dynamic properties of structure. In this paper, the response of a 20-storey benchmark building supplemented by viscous dampers and Negative Stiffness Device (NSD) is assessed by numerical simulations using the Newmark-beta method. True negative stiffness is an adaptive passive device which assists the motion unlike positive stiffness. The structure used in this study is subjected to four standard ground motions varying from moderate to severe, near fault to far-field earthquakes. The objective of the present study is to show the effectiveness of the adaptive negative stiffness device (NSD and passive dampers together) relative to passive dampers alone. This is done by comparing the responses of the above uncontrolled structure (i.e., without any device) with the structure having passive dampers only and also with the structure supplemented with adaptive negative stiffness device. Various performance indices, top floor displacement, top floor acceleration and inter-storey drifts are used as comparison parameters. It is found that NSD together with passive dampers is quite effective in reducing the response of aforementioned structure relative to structure without any device or passive dampers only. Base shear and acceleration is reduced significantly by incorporating NSD at the cost of increased inter-storey drifts which can be compensated using the passive dampers.

Keywords : adaptive negative stiffness device, apparent yielding, NSD, passive dampers

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