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Improvement of Concrete Shear Wall Structures by Smart Materials

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ABSTRACT

Smart materials have found numerous applications in many areas in civil engineering recently. One class of these materials is shape memory alloy (SMA) which exhibits several unique characteristics such as superelasticity and shape memory effect. Due to these characteristics, research efforts have been extended to use SMA in controlling civil structures. This paper investigates the effectiveness of SMA reinforcements in enhancing the behavior of shear walls, especially when subjected to seismic excitations. Two ordinary and coupled shear walls were introduced as reference structures and were modeled by ABAQUS software. For improving the seismic response of the shear walls, vertical SMA reinforcing bars were proposed to be implemented like conventional steel reinforcements, throughout the height of the structures and in every connecting beam in the coupled shear wall system. The one dimensional superelastic model of SMA material was implemented in the computer software using FORTRAN code. The dynamic response of the shear walls subjected to seismic loading was investigated through time history analyses under El-centro and Koyna records. The results showed that using superelastic SMA material instead of steel bars caused remarkable reduction in residual displacement for both ordinary and coupled shear walls. In addition, SMA reinforcements could significantly decrease the maximum deflection of the coupled shear wall system.

KEYWORDS

Smart Material; Shape Memory Alloy; Shear Wall; Superelasticity; Seismic Behavio

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