YIELDING-CURVED-BARS & HEMISPHERE CORE ENERGY DISSIPATING DEVICE AS THE CENTRAL SUPPORT OF REPAIRABLE BUILDINGS WITH SEE-SAW MOTION

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Design of repairable buildings, i. e. the buildings whose structural systems can be easily repaired after a major earthquake, instead of demolishing and rebuilding, have been paid great attention by some researchers in recent decade. Use of rocking mechanism of the building's structure (Azuhata, 2004) and employing telescopic columns in buildings with rocking motion (Hosseini and Noroozinejad Farsangi, 2012) are two samples of these researches. More specifically, using a multi-stud energy dissipating device as the central fuse for regular steel buildings with rocking motion (Hosseini and Kherad, 2013) can be mentioned as a study in which specific attention has been paid to the behavior of the central support which has a main role in creating the possibility of rocking motion or see-saw motion (to be more precise) in the building's structural system.

In this study a somehow-innovative energy dissipater which can act as the central support of the building with see-saw motion is introduced. Figure 1 shows a general view and a section of the device.

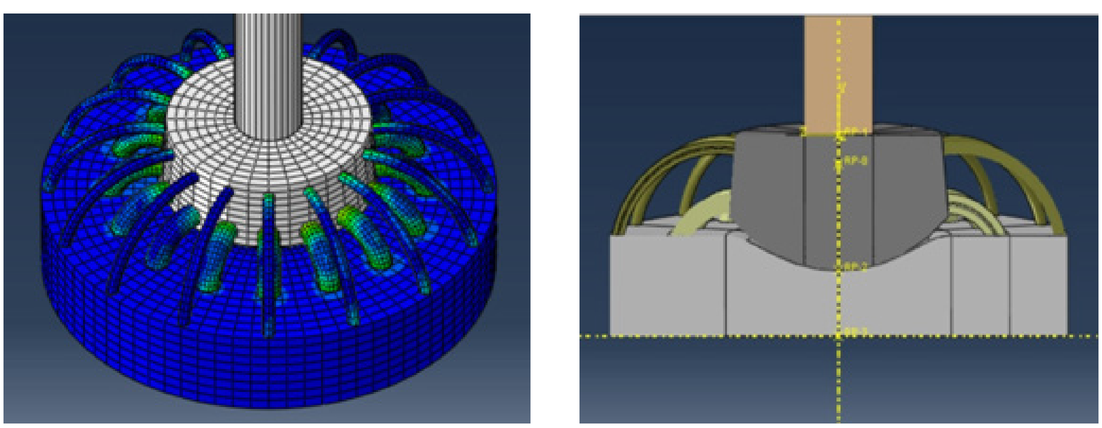

Figure 1. General view and section of the Yielding-Curved-Bars and Clipped Hemisphere Core energy dissipater

Looking at Figure 1, the proposed device can be called Yielding Curved Bars and Clipped Hemisphere Core (YCB & CHC or more briefly YCB) energy dissipater. As it can be understood from Figure 1, the YCB energy dissipater can act as the central support under the central main column of the building at its base lowest level. The clipped hemisphere carries the vertical load of the central column of the building with see-saw motion, and transfer it directly to its concave bed, while the curved bars around the clipped hemisphere act as yielding elements during the see-saw motion of the building which causes the central column to incline, as shown in Figure 2, and this inclination cause the rotation of the YCB device around a horizontal axis, resulting in large plastic deformations of curved rods (as it is seen in the figure), and therefore, large amount of energy dissipation during earthquake excitations.

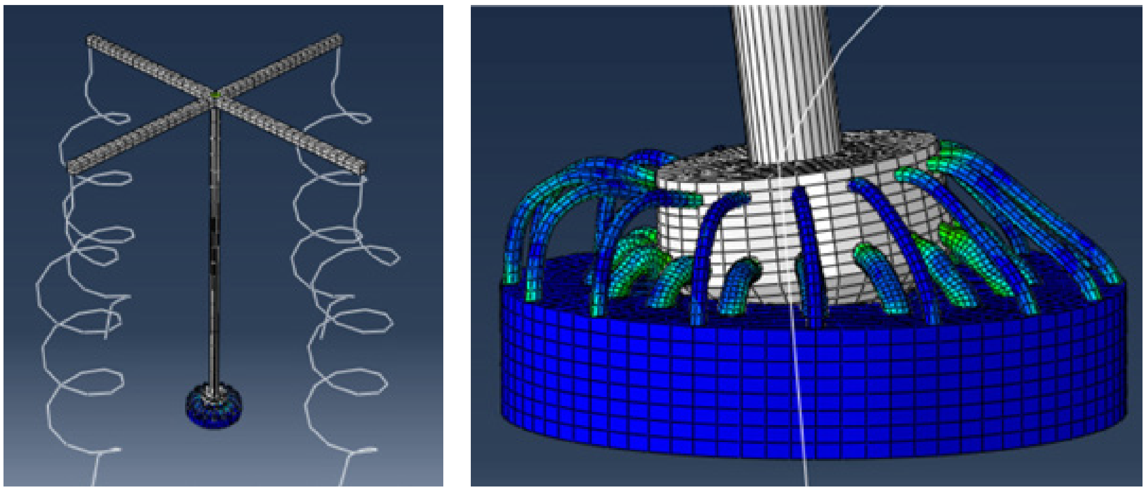

Figure 2. Simplified model of the building's structure with see-saw motion (left) and the plastic deformation of the YCB energy dissipater and central support due to the inclination of the building's central column (right)

The YCB device was modeled in a powerful finite element analysis software and its hysteretic behavior under the simultaneous effects of vertical and horizontal loads was investigated. Figure 3 shows a sample of the hysteretic loops of the YCB device subjected to the cyclic displacement (rotation) controlled excitation with increasing amplitude under a constant vertical load.

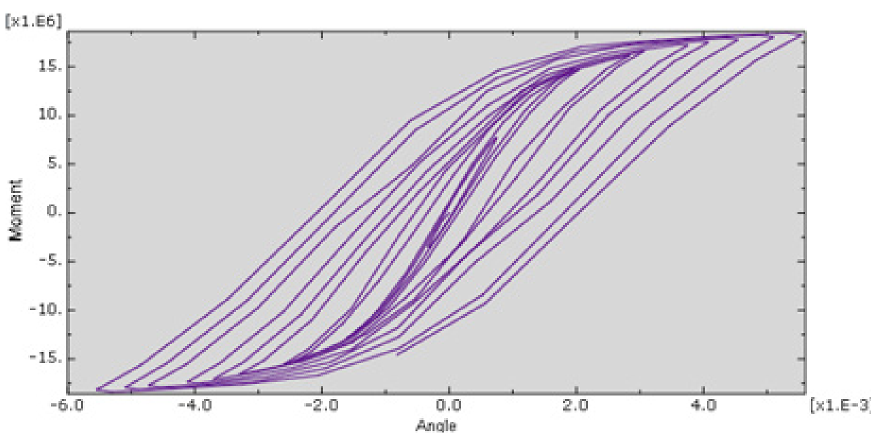

Figure 3. A sample moment-rotation hysteresis of the YCB device (Moment in N.m and Rotation Angle in rad)

The satisfactory performance of the YCB device was shown by introducing it to a multi-story building model by multi-linear plastic springs and calculating the seismic responses.

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