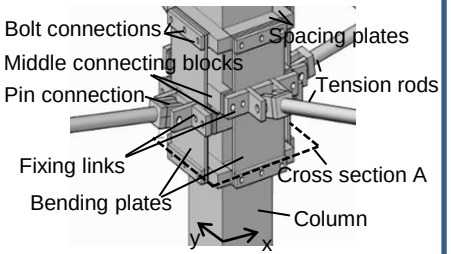
Minimal-disturbance arm damper (MDAD) for bidirectional loading

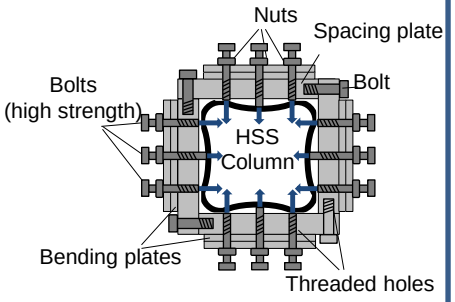
Background: Minimal-disturbance arm damper (MDAD) has been developed to improve the seismic performance of steel frames by restraining local deformation at bottom flanges of beam ends. The MDAD was verified to work excellent for unidirectional loading but the influence of out-of-plane deformation under bidirectional earthquake loading was not examined yet.

Objectives: The primary objectives of this research are: (1) to investigate the performance of MDAD under bidirectional loading and quantify the effect of out-plane deformation; (2) to improve the plate-column attachment and prevent the slippage of MDAD on the column. The performance of MDAD with modified plate-column attachment is investigated by two sets of bidirectional loading tests: quasi-static cyclic loading tests and dynamic tests with sinusoidal wave input.

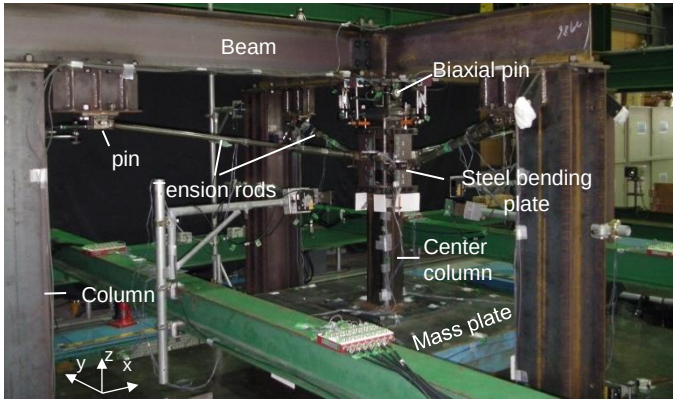
Modified configuration of MDAD



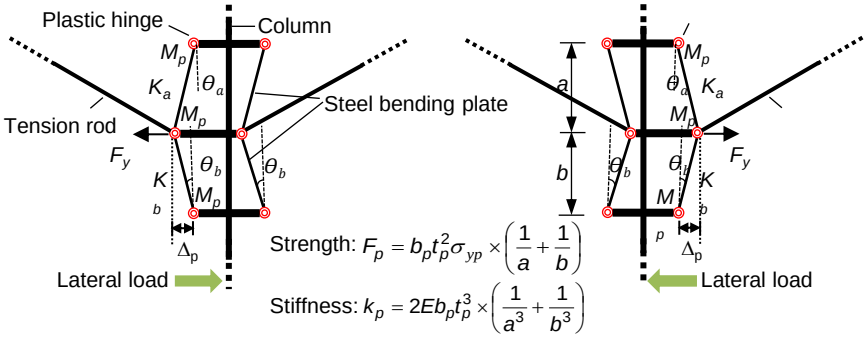
Modified MDAD



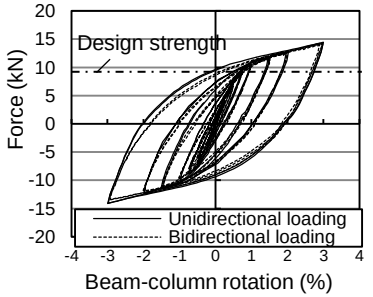
Modified plate-column attachment at cross section A



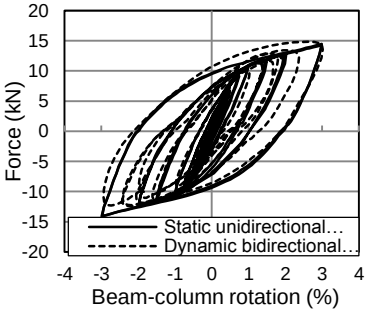
Component test setup (½ scaled) for dynamic loading



Mechanism of energy-dissipation



Quasi-static test



Comparison of static and dynamic behaviors

Conclusion: The tests results showed the stable hysteretic behavior of MDAD both for unidirectional and bidirectional loadings. The performance of MDAD in a direction was concluded independent to the loading in the other direction. Thus, there was no effect of out-of-plane deformation on the in-plane behavior. In the dynamic tests, no rate-dependency in MDAD was observed.