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FLAG-SHAPED BEHAVIOR DAMPER USING THE COMBINATION OF FRICTION AND RUBBER SPRINGS

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Summary: This study proposes a new concept of a smart damper to provide flag-shaped behavior using the combination of magnetic friction and rubber springs. The magnet provides energy dissipation due to friction, and the rubber springs with precompression contribute to increasing the recentering capacity of the damper. To verify their performance, dynamic tests of magnet frictional dampers and precompressed rubber springs were conducted. For this purpose, hexahedron neodymium (NdFeB) magnets and polyurethane rubber cylinders were used. In the dynamic tests, the loading frequency was varied from 0.1 to 2.0 Hz. The magnets showed almost perfect rectangular behavior in the force-deformation curves, and the frictional coefficient of the magnets was estimated through averaging and regression. The rubber springs were tested with and without precompression. The rubber springs showed different loading path from the second cycle and residual deformation that was not recovered immediately. The precompressed rubber spring showed rigid-elastic behavior with hysteresis in the elastic region. The rubber springs showed greater rigid force with increasing precompression. Finally, this paper discusses the combination of rigid-elastic behavior and friction to generate 'flag-shaped' behavior for a smart damper and suggests how to combine magnets and rubber springs to obtain flag-shaped behavior. The performance of the magnets and precompressed rubber springs was verified through analytical models.