

## Effect of Damper Combinations in Series or Parallel on Structural Response

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**Abstract :** Passive energy dissipation method for earthquake protection of structures is undergoing developments for improved performance. Combined use of different types of damping mechanisms has shown positive results in the near past. Different supplemental damping methods like viscous damping, frictional damping and metallic damping are being combined together for optimum performance. The conventional method of connecting passive dampers to structures is a parallel connection between the damper unit and structural member. Researchers are investigating coupling effect of different types of dampers. The most popular choice among the research community is coupling of viscous dampers and frictional dampers. The series and parallel coupling of these damping units are being studied for relative performance of the coupled system on response control of structures against earthquake. In this paper an attempt has been made to couple Fluid Viscous Dampers and Frictional Dampers in series and parallel to form a single unit of damping system. The relative performance of the coupled units has been studied on three dimensional reinforced concrete framed structure. The current theories of structural dynamics in practice for viscous damping and frictional damping have been incorporated in this study. The time history analysis of the structural system with coupled damper units, uncoupled damper units as well as of structural system without any supplemental damping has been performed in this study. The investigations reported in this study show significant improved performance of coupled system. A higher natural frequency of the system outside the forcing frequency has been obtained for structural systems with coupled damper units as against the other cases. The structural response of the structure in terms of storey displacement and storey drift show significant improvement for the case with coupled damper units as against the cases with uncoupled units or without any supplemental damping. The results are promising in terms of improved response of the structure with coupled damper units. Further investigations in this regard for a comparative performance of the series and parallel coupled systems will be carried out to study the optimum behavior of these coupled systems for enhanced response control of structural systems.

**Keywords :** frictional damping, parallel coupling, response control, series coupling, supplemental damping, viscous damping

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