



Seismic Response Control of Elevated Liquid Storage Tank Using Negative Stiffness and Inerter Based Dampers

Naqeeb Ul Islam¹, Shiv Prakash², R S Jangid³

¹PhD Student, Dept. of Civil Engineering, IIT Bombay, Mumbai, India 400076

²PhD Student, Dept. of Civil Engineering, IIT Bombay, Mumbai, India 400076

³Professor, Dept. of Civil Engineering, IIT Bombay, Mumbai, India 400076

Abstract

The effect of novel negative stiffness and inerter based damper (NSID) for seismic response control of elevated liquid storage tanks is investigated. Liquid storage tanks form important structures that must stay in working condition during earthquakes. Herein, NSID is employed as a supplemental damper to elevated liquid storage tanks. The tank's continuous liquid mass is represented as two lumped masses: sloshing mass and rigid mass. The tank wall and liquid mass specifications are used to compute the stiffness constant related to these lumped masses. Time history analysis is carried out under real earthquake records to investigate the performance of NSIDs as supplemental dampers. The differential equations of motion are written in state-space form. The NSID parameters are subjected to a parametric analysis, and the best parameters are identified. Response quantities like base shear, liquid sloshing displacements and rigid mass accelerations are controlled efficiently using the NSIDs.

Keywords: Negative stiffness inerter damper, Seismic response, Liquid storage tanks, Supplemental dampers