

Response spectrum analysis of mid-story seismically isolated building structures

Federica Genovese, Giuseppe Muscolino

Abstract: Among the increasing practical applications, the mid-story isolation system (MSIS), in which the isolation devices are typically installed at the top of the first story of a building, has recently gaining popularity because it can satisfy both architectural concerns of aesthetics and functionality. The dynamic behaviour of a mid-story isolated structure and a base isolated structure (BIS) may not be identical since the seismic responses of a mid-story isolated building may be significantly affected by the flexibility of the substructure. Indeed, in this case the structural system must be considered as composed by three substructures: the superstructure, above the MSIS, assumed as a multi-storey building; the substructure below the MSIS composed only by columns; the MSIS itself. Moreover, the three subsystems, usually assumed as classically damped, have different damping ratios, which have to be taken into account in adequate manner in response spectrum analysis (RSA). It follows that to be effective in practice, the RSA for these systems should embed the following features: i) reduced computational effort, avoiding the calculation of complex-valued eigenproperties; ii) accurate representation of the damping, properly taking into account the concentration of energy dissipation at the three structural subsystems. These requirements are inherent in the damping-adjusted combination rule that, in this paper, is detailed for the seismic analysis and design of mid-story isolated buildings. The new proposed approach for MSIS is numerically validated by Monte-Carlo simulation.

¹⁾ Federica Genovese, M.Sc. (Ph.D. student): Department of Engineering, University of Messina, C.da Di Dio - Villaggio S. Agata - 98166 Messina, Italy (IT), fedgenovese@unime.it.

²⁾ Giuseppe Muscolino, Professor: Department of Engineering, University of Messina, C.da Di Dio - Villaggio S. Agata - 98166 Messina, Italy (IT), gmuscolino@unime.it, the author presented this contribution at the conference in the special session "Innovative strategies for vibration control and mitigation" organized by G. Failla and R. Santoro.