Abstract

The modal analysis is one of the existing procedures for dynamic analysis of systems. In ordinary systems containing uniformly distributed damping, the damping matrix can be written as a combination of mass and stiffness matrices and eigen values as well as eigen vectors are real values. However there are some cases resulting in non-classic damping matrices mainly due to a non-uniform distribution of damping. In such cases, the damping matrix can not be constructed by combining mass and stiffness matrices and the eigen values and eigen vectors will be complex-valued. These are called non-classic systems.

In this thesis two special cases of non-classical system, namely, structure resting flexible bases and structures having concentrated dampers at certain levels, are studied and their dynamical behavior with respect to classical systems is compared. In such a study, dynamic equations of non-classical systems are derived using different perspectives and time-histories of floor displacements, and story and base shears are computed.

Varying dynamical condition like concentrating damping in specific stories or at the base level, the sensitivity of different responses is calculated. An important example is passive control systems containing viscous dampers at different levels.

With respect to the structures having concentrated damper, the results for twelve different non-classic cases are compared to the classic case in spectral analysis. For a certain case, the above comparative analysis is repeated using time history analysis showing an increase in the response in conditions.

Structures resting on a flexible base are the second system study in this thesis and their responses are compared to the fixed-base structures. First, using spectrum analysis on different soils, the period interval of the structures sensitive to soil-structure interaction and that of the structures sensitive to the type of the analysis are determined. Then, using time history analysis, the design spectra are calculated for the sensitive interval. Finally, application of calculated design spectra for the analysis of flexibly based structures is established.