

Response Spectrum Analysis

In a response spectrum analysis, the results of a modal analysis are used in terms of a known spectrum to calculate displacements and stresses in the model. For each mode, a response is read from a design spectrum based on the modal frequency and a given damping ratio. All modal responses are then combined to provide an estimate of the total response of the structure.

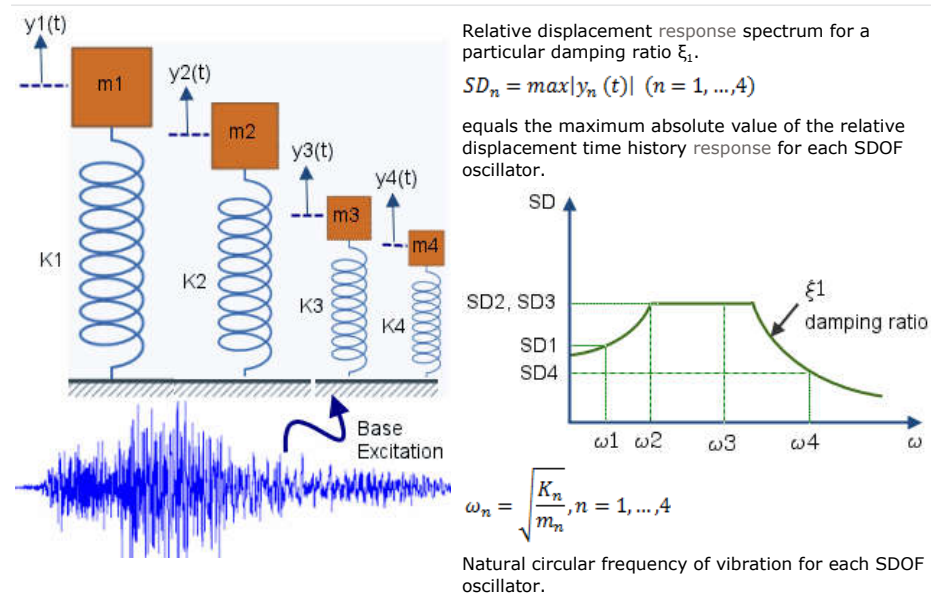
You can use a response spectrum analysis rather than a time history analysis to estimate the response of structures to random or time-dependent loading environments such as earthquakes, wind loads, ocean wave loads, jet engine thrust or rocket motor vibrations.

Response Spectrum Plots peak responses over time for a range of single-degree-of-freedom (SDOF) systems subjected to a particular base motion as a function of their natural frequency ω_i , or vibration period T_i . Each response spectrum curve corresponds to a particular modal damping ratio ξ_i .

Typical quantities plotted in response spectra are:

- Maximum displacement $S_d(\omega_i, \xi_i)$
- Maximum pseudo-velocity $S_v(\omega_i, \xi_i) = \omega_i * S_d$
- Maximum pseudo-acceleration $S_a(\omega_i, \xi_i) = \omega_i^2 * S_d$

The response spectrum is used as base excitation input for a response spectrum analysis.



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CONTENTS

Analysis Procedure - Response Spectrum Analysis

The normal modes are calculated first to decouple the equations of motion with the use of generalized modal coordinates. The maximum modal responses are determined from the base excitation response spectrum. With the use of modal combination techniques, the maximum structural response is calculated by summing the contributions from each mode.

Mode Combination Techniques

The maximum structural response is calculated by summing the contributions from each mode.

Performing a Response Spectrum Analysis

Response Spectrum Analysis Options

The dialog controls the mode combination technique for the calculation of the maximum response in a response spectrum analysis.