Question 30

Murata Software

Q: When the damping ratio between two resonant frequencies is given, how to transfer it into the Rayleigh damping coefficients *?

*The Rayleigh damping coefficients can be used to represent damping in transient analysis.

A: The Rayleigh damping coefficients are calculated from the damping ratio between two resonant frequencies using two equations; the equations correlating the damping ratio with the Rayleigh damping coefficients are solved simultaneously in the two frequencies (See the next slide for more information).

Please refer to the help menu below for equations correlating the damping ratio with the Rayleigh damping coefficients :
Home>Technical Notes>Stress Analysis>Mechanical Damping.

$$\zeta_i = \frac{1}{2}\left(\frac{\alpha}{\omega_i} + \beta\omega_i\right) \quad \cdots (2\text{-}6\text{-}6)$$

ζ: Damping ratio, ω: Each velocity, α,β: Coefficient, i: i-th eigen mode

$$\zeta_1 = \frac{1}{2}\left(\frac{\alpha}{\omega_1} + \beta\omega_1\right) \quad \cdots (2\text{-}6\text{-}7)$$

$$\zeta_2 = \frac{1}{2}\left(\frac{\alpha}{\omega_2} + \beta\omega_2\right) \quad \cdots (2\text{-}6\text{-}8)$$

Solving these equations simultaneously in α and β will give the results below.

$$\alpha = \frac{2\omega_1\omega_2(\zeta_1\omega_2 - \zeta_2\omega_1)}{\omega_2^2 - \omega_1^2} \quad \cdots (2\text{-}6\text{-}9)$$

$$\beta = \frac{2(\zeta_2\omega_2 - \zeta_1\omega_1)}{\omega_2^2 - \omega_1^2} \quad \cdots (2\text{-}6\text{-}10)$$