

## #1289: OptiStruct – Damping in Frequency Response Analysis

**Product:** OptiStruct

**Product Version:** OptiStruct 12.0 or above

### Topic Objective

Damping in frequency response analysis using OptiStruct

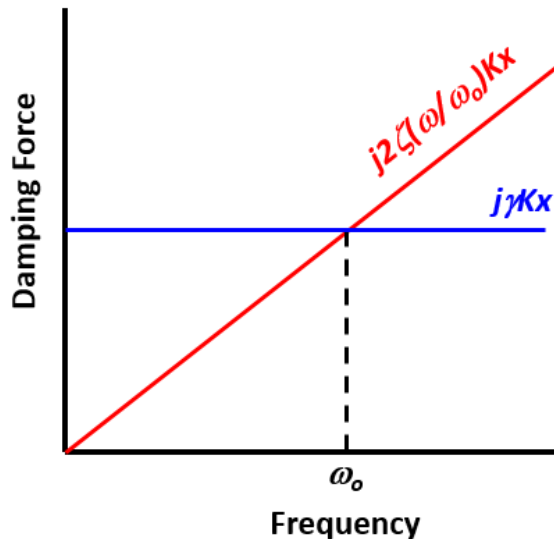
### Topic Details

Velocity proportional damping

- Damping force  $F = j\omega Cx = j2z(w/w_0)Kx$
- where  $z$  is the percentage of the critical damping
- Usually called viscous damping

Displacement proportional damping

- Damping force  $F = jHx = jgKx$
  - where  $g$  is the percentage of the stiffness
  - OptiStruct calls it structural damping
  - Many vibration textbooks call it hysteretic damping
- Viscous damping forces and structural damping forces are not the same:  $j2z(w/w_0)Kx$  vs  $jgKx$
  - At resonance only:  $g=2z$
  - Some people describe structural damping as  $GE=2C/C_0$ .
  - This is only true at resonance.



### PARAM,G

1. Structural damping (displacement proportional)
2. Dimensionless, percent of stiffness
3. Applied to the entire structure

4. For example, to represent structural damping that is equal to 3% viscous damping at resonance, use 6% structural damping, i.e., 0.06.

## SDAMP/TABDMP1

1. Always viscous damping (velocity proportional) whether G, CRIT or Q is specified on TABDMP1
2. Dimensionless, percent of critical damping
3. Applied to the entire structure
4. For example, each of the following produce 3% viscous damping
  - **G**      **0.06**
  - **CRIT** **0.03**
  - **Q**      **16.67**

## Element Damping – B

1. CDAMP, CVISC, CBUSH
2. Viscous damping (velocity proportional)
3. Units are N sec / mm
4. Applied only to the elements that reference that property.

## Element Damping – GE

1. MAT1, CELAS, CBUSH
2. Structural damping (displacement proportional)
3. Dimensionless, percent of stiffness
4. Applied only to the elements that reference that material or property.
5. On an element level:  $[K_{GE}] = GE[K]$ .
6. For example, to represent structural damping that is equal to 3% viscous damping at resonance, use 6% structural damping, i.e., 0.06.

Note: There is no way to enter a non-zero  $K_{GE}$  with a zero K.