response, F_{iR}, of the structure in the direction of interest shall be determined in accordance with Eqs. 18.5-16 and 18.5-17:

$$F_{i1} = w_i \phi_{i1} \frac{\Gamma_1}{\overline{W}_1} V_1 \qquad (18.5\text{-}16)$$

$$F_{iR} = w_i \phi_{iR} \frac{\Gamma_R}{\overline{W}_R} V_R \qquad (18.5\text{-}17)$$

Design forces in elements of the seismic force-resisting system shall be determined by taking the SRSS of the forces due to fundamental and residual modes.

18.5.3 Damping System

Design forces in damping devices and other elements of the damping system shall be determined on the basis of the floor deflection, story drift, and story velocity response parameters described in the following sections.

Displacements and velocities used to determine maximum forces in damping devices at each story shall account for the angle of orientation of each device from the horizontal and consider the effects of increased response due to torsion required for design of the seismic force-resisting system.

Floor deflections at Level i, δ_{iD} and δ_{iM}, story drifts, Δ_D and Δ_M, and story velocities, ∇_D and ∇_M, shall be calculated for both the design earthquake ground motions and the maximum considered earthquake ground motions, respectively, in accordance with the following sections.

18.5.3.1 Design Earthquake Floor Deflection

The total design deflection at each floor of the structure in the direction of interest shall be calculated as the SRSS of the fundamental and residual mode floor deflections. The fundamental and residual mode deflections due to the design earthquake ground motions, δ_{i1D} and δ_{iRD}, at the center of rigidity of Level i of the structure in the direction of interest shall be determined using Eqs. 18.5-18 and 18.5-19:

$$\delta_{i1D} = D_{1D} \phi_{i1} \qquad (18.5\text{-}18)$$

$$\delta_{iRD} = D_{RD} \phi_{iR} \qquad (18.5\text{-}19)$$

where

D_{1D} = fundamental mode design displacement at the center of rigidity of the roof level of the structure in the direction under consideration, Section 18.5.3.2

D_{RD} = residual mode design displacement at the center of rigidity of the roof level of the structure in the direction under consideration, Section 18.5.3.2

18.5.3.2 Design Earthquake Roof Displacement

Fundamental and residual mode displacements due to the design earthquake ground motions, D_{1D} and D_{1R}, at the center of rigidity of the roof level of the structure in the direction of interest shall be determined using Eqs. 18.5-20 and 18.5-21:

$$D_{1D} = \left(\frac{g}{4\pi^2}\right)\Gamma_1 \frac{S_{DS} T_{1D}^2}{B_{1D}} \geq \left(\frac{g}{4\pi^2}\right)\Gamma_1 \frac{S_{DS} T_1^2}{B_{1D}}, \; T_{1D} < T_S \qquad (18.5\text{-}20a)$$

$$D_{1D} = \left(\frac{g}{4\pi^2}\right)\Gamma_1 \frac{S_{D1} T_{1D}}{B_{1D}} \geq \left(\frac{g}{4\pi^2}\right)\Gamma_1 \frac{S_{D1} T_1}{B_{1E}}, \; T_{1D} \geq T_S \qquad (18.5\text{-}20b)$$

$$D_{RD} = \left(\frac{g}{4\pi^2}\right)\Gamma_R \frac{S_{D1} T_R}{B_R} \leq \left(\frac{g}{4\pi^2}\right)\Gamma_R \frac{S_{DS} T_R^2}{B_R} \qquad (18.5\text{-}21)$$

18.5.3.3 Design Earthquake Story Drift

Design story drifts, Δ_D, in the direction of interest shall be calculated using Eq. 18.5-22:

$$\Delta_D = \sqrt{\Delta_{1D}^2 + \Delta_{RD}^2} \qquad (18.5\text{-}22)$$

where

Δ_{1D} = design story drift due to the fundamental mode of vibration of the structure in the direction of interest

Δ_{RD} = design story drift due to the residual mode of vibration of the structure in the direction of interest

Modal design story drifts, Δ_{1D} and Δ_{RD}, shall be determined as the difference of the deflections at the top and bottom of the story under consideration using the floor deflections of Section 18.5.3.1.

18.5.3.4 Design Earthquake Story Velocity

Design story velocities, ∇_D, in the direction of interest shall be calculated in accordance with Eqs. 18.5-23 through 18.5-25:

$$\nabla_D = \sqrt{\nabla_{1D}^2 + \nabla_{RD}^2} \qquad (18.5\text{-}23)$$

$$\nabla_{1D} = 2\pi \frac{\Delta_{1D}}{T_{1D}} \qquad (18.5\text{-}24)$$