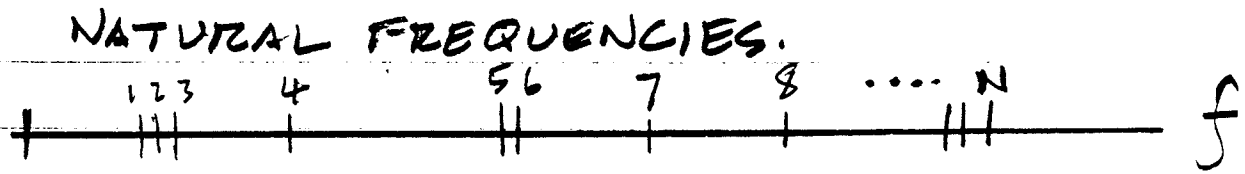


METHODS FOR COMBINING MODES



N = total modes considered

Z = total number of modes considered to be close

H = number of sets of equal or close eigen values

K = number of close frequencies in any set

σ_{mp}^2 = mean square value of p th mode response

ϕ_{ip} = mode vector, coordinate i in p th mode

① STRESS $\sigma_{g_1} = \left[\sum_{p=1}^N (\phi_{ip}^2 \sigma_{rp}^2) \right]^{1/2}$

② ABSOLUTE METHOD $\sigma_{g_1} = \sum_{p=1}^N (|\phi_{ip} \sigma_{rp}|)$

3) NZL METHOD

$$\sigma_{g_1} = |\phi_{11} \sigma_{\eta_1}| + \left[\sum_{p=2}^N \phi_{1p}^2 \sigma_{\eta p}^2 \right]^{\frac{1}{2}}$$

4) CLOSE METHOD:

$$\sigma_{g_1} = \sum_{p=1}^Z (|\phi_{1p} \sigma_{\eta p}|) + \left[\sum_{p=Z+1}^{N-Z} (\phi_{1p}^2 \sigma_{\eta p}^2) \right]^{\frac{1}{2}}$$

5) MRSS

$$\sigma_{p_1} = \left[\sum_{j=1}^H \left[\sum_{p=1}^K (|\phi_{jp} \sigma_{\eta p}|) \right]^2 + \sum_{p=Z+1}^{N-Z} (\phi_{jp}^2 \sigma_{\eta p}^2) \right]^{\frac{1}{2}}$$

6) CQC (Combined Quadratic Combination)

$$\sigma_{g_1} = \left[\sum_{i=1}^N \sum_{k=1}^N \sigma_{1i} \rho_{ik} \sigma_{1k} \right]^{\frac{1}{2}}$$

$$\sigma_{ii} = \phi_{ii} \sigma_{\eta i}$$

$$\rho_{ik} = \frac{8\sqrt{\zeta_i \zeta_k} (\zeta_i + r \zeta_k) r^{3/2}}{(1-r^2)^2 + 4\zeta_i \zeta_k r (1+r^2) + 4(\zeta_i^2 + \zeta_k^2) r^2}$$

$$r = \frac{\omega_k}{\omega_i} \quad k > i$$

e.g. For 2 modes.

$$\begin{aligned} \sigma_j &= \sigma_{j1}^2 \rho_{11} + \sigma_{j1} \rho_{12} \sigma_{j2} + \sigma_{j2} \rho_{21} \sigma_{j1} + \sigma_{j2}^2 \rho_{22} \\ &= \sigma_{j1}^2 + 2 \rho_{12} \sigma_{j1} \sigma_{j2} + \sigma_{j2}^2 \end{aligned}$$