The vibration is described in a piecewise fashion as switching between the linear in-contact and not-in-contact states.

The model is discretized through the subset of N modes \( \Phi \) in each state such that

\[
\ddot{u}^{(i)}(x, t) \approx \sum_{m=1}^{N} \tilde{R}_{mn}^{(i)}(t) \phi_{mn}^{(i)}(x)
\]

where

\[
\tilde{R}_{mn}^{(i)} + 2 \zeta_m \omega_m \tilde{R}_{mn}^{(i)} + \omega_m^2 \tilde{R}_{mn}^{(i)} = (f, \phi_{mn}^{(i)})
\]

As \( k \) increases, the structure of the repetitive impact frequency response functions also increases in sophistication.

For \( E_1 I_1 / (E_2 I_2) = \frac{1}{3} \), a minor anti-resonance exists, signifying passive vibration control targeted at specific excitation frequencies.