

**Thoughts On Fitting Input Time Histories To Obtain Reliable Dynamic Results**  
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Previous studies have shown that dynamic response and in-structure response spectra, calculated from different time histories, fit to the same target spectra can vary significantly. This phenomena is typically due to local variations (dips/gaps) in the Fourier spectra. There are several strategies for mitigating this problem:

- 1) Use RVT to avoid time history analyses altogether. On the surface RVT analyses appear to be a panacea. However, RVT analyses have a separate set of issues which are outside the scope of this presentation.
- 2) Perform a supplemental Power Spectral Density (PSD) check in addition to meeting the target response spectra. The PSD check uses a smoothed PSD which could disguise a local variation in the Fourier spectra and could result in an under-prediction of response.
- 3) Increase the number of frequency points where the time history is shown to fit the target response spectra and provide a tight fit to the target spectra to promote uniform spectral energy without gaps. This criterion was proposed by NUREG/CR-6728, is implemented in ASCE 43-05 and ASCE 4-16, which resulted in an incremental improvements in response reliability.
- 4) Perform the analysis using multiple redundant time histories.

Intuitively, if we have two or more independent time histories, then it is unlikely that a dip or gap in the Fourier spectra would occur at the same frequency in each of those time histories. This presentation will examine the reliability of dynamic results considering suites of redundant input time histories. The results processing will consider enveloping, averaging and median results of the suite of time histories. The reliability of dynamic results given of suites of 2, 3, 5 and 7 redundant input time histories will be developed.