Notes concerning why RS for large damping can be greater than RS for a smaller damping

David M. Boore

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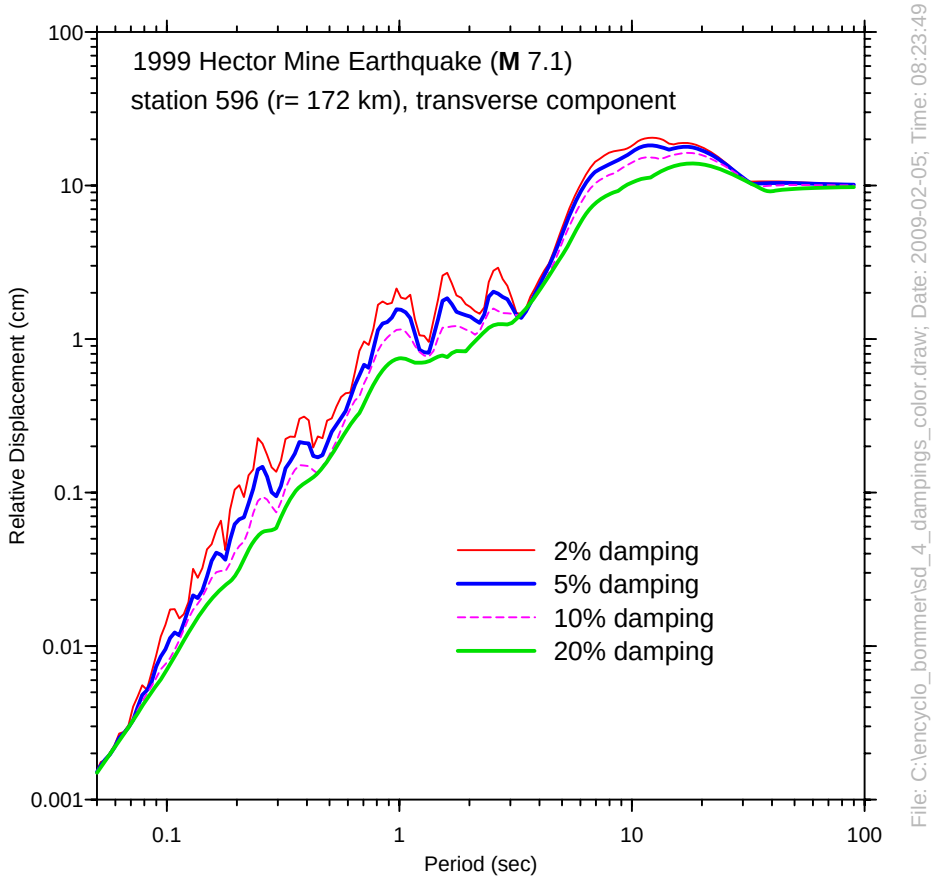
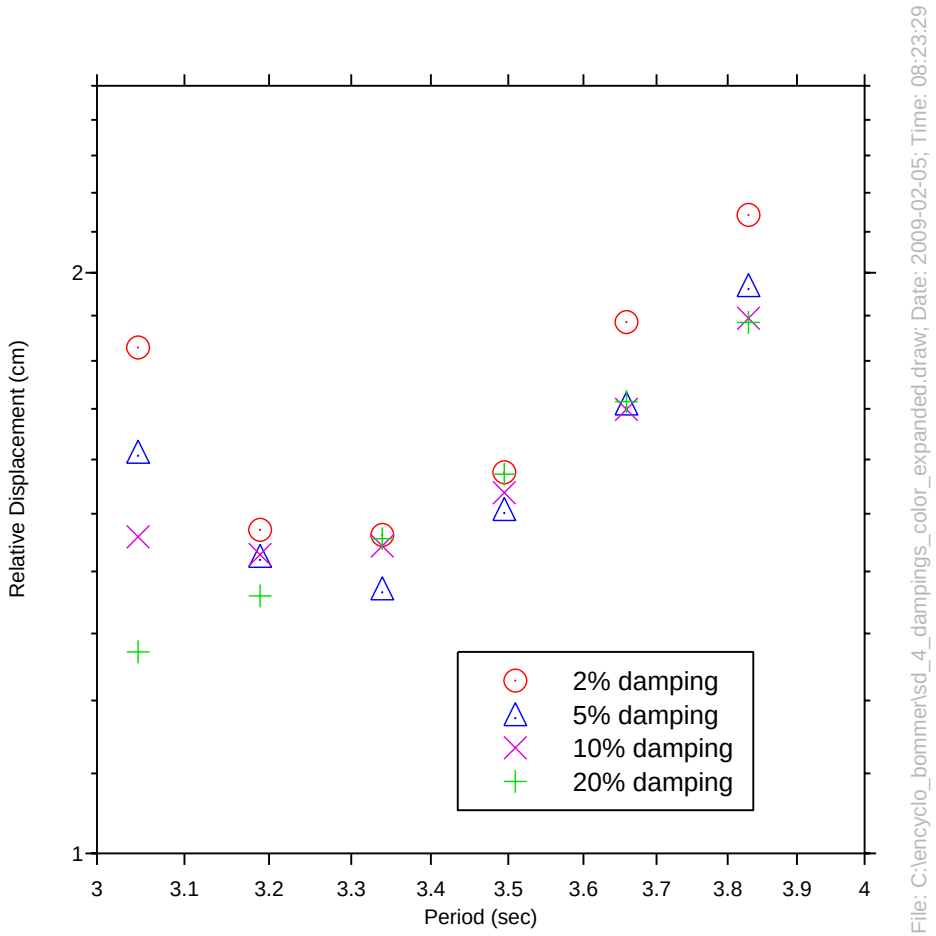
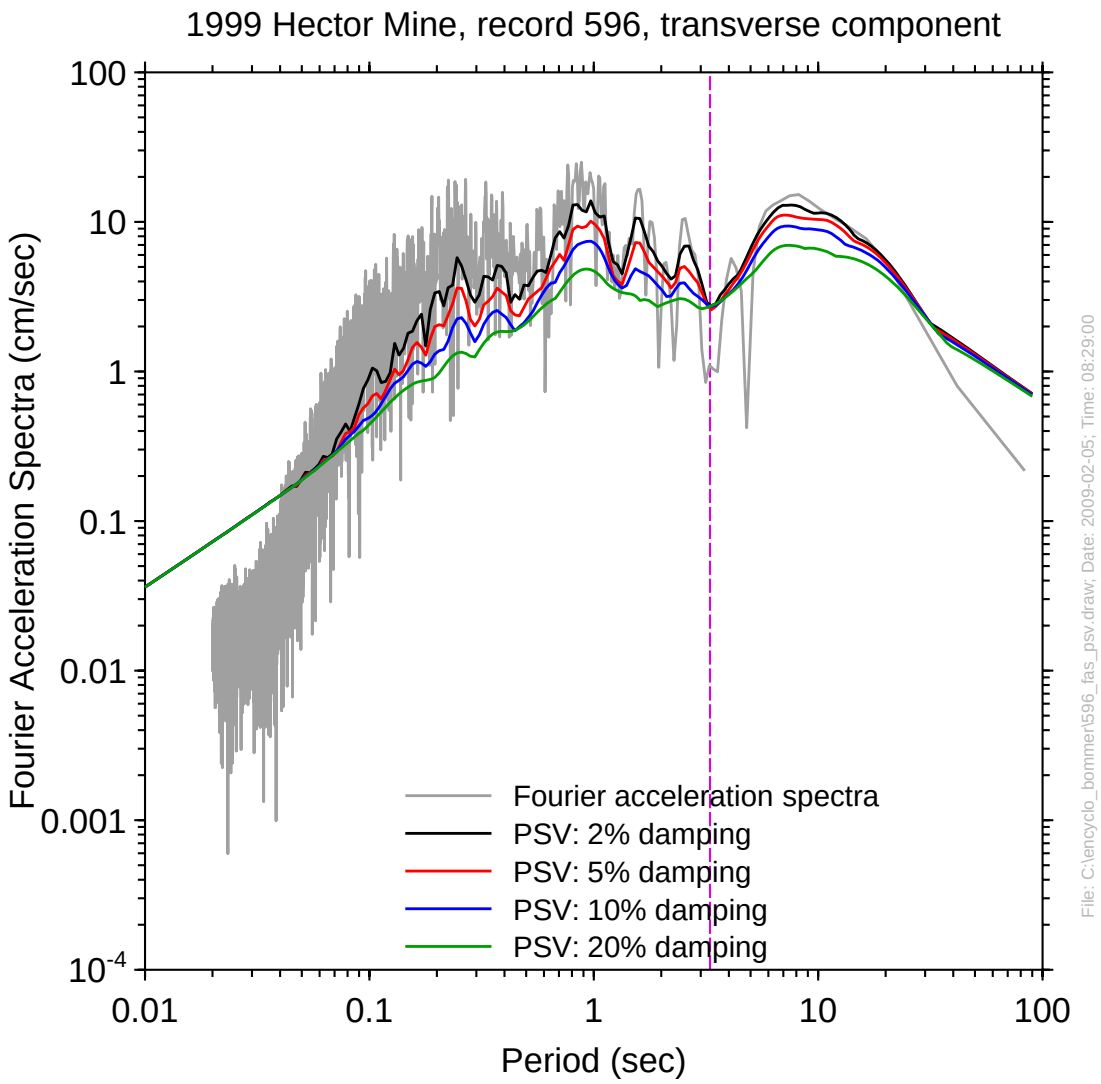
Consider this SD for four dampings:



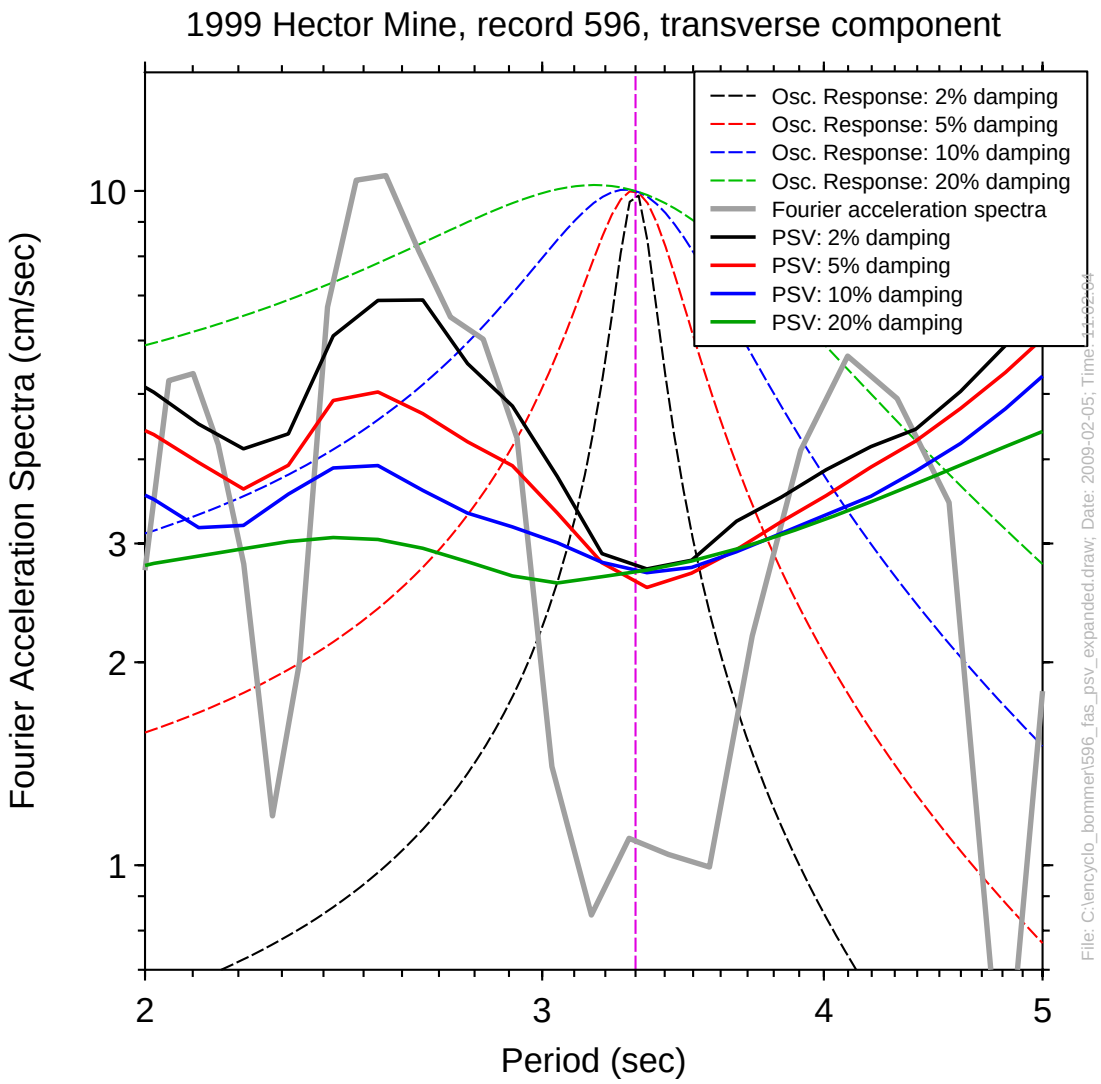
Note that the curves come very close together at T=3.3 s. Let's blow up this portion to see the details:



It is clear that SD for 10 and 20 % damping are larger than for the 5% damped oscillator for periods around 3.3 s. Is this a mistake? No, and the reason for the relative size of the SD for different dampings is due to the interplay between the oscillator response and the Fourier acceleration spectrum. As the next figure shows, there is a hole in the FAS around 3.3 s.



A expanded version of the figure above is shown next. The oscillator response functions (normalized to 10 when T=3.3 s) are also shown in the figure. Note that the 20%-damped response is much broader than the more lightly damped oscillator. The response of an oscillator with heavy damping and a period corresponding to a strong hole in the FAS is determined by the FAS at adjacent periods. This is the essence of the explanation for the peculiar behavior seen in the second figure.


1999 Hector Mine, record 596, transverse component
Osc. Response: 2% damping
Osc. Response: 5% damping
Osc. Response: 10% damping
Osc. Response: 20% damping
Fourier acceleration spectra
PSV: 2% damping
PSV: 5% damping
PSV: 10% damping
PSV: 20% damping
Fourier Acceleration Spectra (cm/sec)
10
3
2
1
2
3
4
5
Period (sec)
File: C:\encyclo_bommer\596_fas_psv_expanded.draw; Date: 2009-02-05; Time: 11:02:04