Long, JA (Judy)

Subject: FW: SPIRE-COM : check of BSM load response

bsm-random-vib-input_ v2.xls

SPIRE-ATC-COM-000748

-----Original Message-----
From: Ian Pain
Sent: Tuesday, July 10, 2001 17:01
To: 'bw@mssl.ucl.ac.uk'
Subject: SPIRE-COM : check of BSM load response

Hi Berend,

I have re-worked the Miles approximations we discussed at Cardiff.
Spreadsheet attached, but my specific questions are in the text below:

I have used :

rms accel = (pi . Fn. Wx(Fn)) / 4L)^0.5

where,
Fn = natural frequency
Wx(Fn) = structure input accel from the PSD at the frequency
L = damping ratio = 1/sqrt(Frequency)

In Cardiff, we had used
equiv accel = 3.(pi.Fn. Wx(Fn)). ampl/2)^0.5

as ampl. = 1/2L these expressions are identical apart from the factor of 3.

I have used a multiplier to estimate the 50% probability peak response compared to the rms (about a factor of 4.6) and a further multiplier (1.27) to give 3-sigma peak response. These are based on formula in my 'bible' - Sarafin (Spacecraft Structures & Mechanisms, NASA/DoD). However, I suspect that your factor of 3 is the MSSL pragmatic equivalent of my 4.6x1.27= 5.8

I am a bit concerned that the assumed damping is too good if we use 1/sqrt(freq). This yields values of ~0.047. I would suspect values of 0.01 would be more realistic (and Sarafin would advise 1/4.sqrt(freq). However they would double my load values so I do not want to take this on lightly and have stayed with the 1/sqrt(freq) you recommended.

Further to this, I re-calculate the flex pivot safe loads. Assuming that they retain a margin of 1.5 IN ADDITION to the Qualification load factor you have inserted (1.5), then I have a problem with flex pivots - the margin on the chop stage pivot is 0.7. The Jiggle stage pivot is OK.

Q1. Can you confirm whether the 3 is a multiplier intended to indicate peak design loads.
Q2. If so, should I be using 3 or 5.8 to go from rms to peak loads?
Q3. Do you have any supporting data to allow me to use 1/sqrt(freq) for damping, or would you advise another value based on experience?
Q4. Have I applied my safety margins correctly? Or, put another way should I remove the 1.5x on my components, to produce a margin on qualification 3 sigma load of the chop stage pivot of 0.7x1.5 = 1.05 = :-)

Best Regards,

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