

CCAUV RMO WG

Branch: Vibration

Proposal for Standardizing on ISO Frequencies

1 Background

Over the past 20 year, capabilities of metrology in vibration have extended various parameters associated with the realisation of national measurement standards (NMS) for vibration. For rectilinear vibration the range of frequencies over which the NMS is realised has extended from a 40 Hz to 5 kHz frequency range quite rapidly to a 1 Hz to 10 kHz frequency range and beyond.

The use of frequencies as defined in the ISO 3, R40 or ISO 226, Acoustics - Preferred frequencies was successfully applied for frequencies up to 5 kHz. It was quickly evident that smaller and smaller frequency increments are required as the accelerometer resonance frequency is approached.

It became customary to use 500 Hz frequency increments for frequencies above 3 kHz. This approach is currently almost followed universally.

As the leaders in metrology and standardization, I believe that with the current practise we are setting a poor example. We advocate the use of the SI and ISO/IEC standards far and wide, except in what we currently do. I am of the opinion that this needs to be addressed.

After some investigation, I'd like to make the following proposal.

2 Proposal

During the 7th CCAUV RMO WG meeting in Paris, a brief proposal was made to follow ISO 226 Acoustics – “Preferred frequencies” for vibration calibration as well.

The proposal is to standardise on ISO frequencies in vibration metrology and to use the ISO 3: Preferred numbers – Series of preferred numbers [2].

This ISO standard defines numbers (frequencies) to three decimal figures for series R10 (1/3 Octave) and series R40 (1/12 Octave).

It is proposed, in general, to use the R10 series of numbers for frequencies up to 3 150 Hz and for frequencies above 3 150 Hz to use the R40 number series. It might be that at higher frequencies (say for instance above 50 kHz) the R80 series needs to be applied for smaller increments.

I use the term, “in general” to suggest that this is not a hard and fast rule, and if a specific circumstance should require more or less frequency points, one may move the series cross over point as needed, but to follow the relevant series of number as defined in the ISO standard.

We know there are exceptions, for instance for ISO 16063-11, method 2, the minimum point method.

Some early suggestions were to use exact frequencies or number series as defined by:

$$f = 10^{n/10} f_r$$

where f_r is the reference frequency 1 kHz and n is an integer, positive or negative.

One advantage of this is that the frequency value may easily be calculated in software programmes.

One disadvantage is that for proper implementation of the Sine Approximation Method (SAM), this leads to very awkward sampling frequencies in order to meet the requirement of integer sine waves to be sampled.

Finally

For frequencies below 1 Hz, do we really require so many frequency points. Let's consider the R5 series:

Table 1: ISO 3 - R5 Number Series

0.1
0.16
0.25
0.4
0.63
1

3 References and Literature

- [1] Preferred Numbers: http://sizes.com/numbers/preferred_numbers.htm
- [2] ISO 3 Preferred numbers – Series of preferred numbers
- [3] ISO 226 Acoustic – Preferred frequencies