Aalborg Universitet

Chairmans Report on Discussion of ISO/DIS 7196, "Acoustics - Methods for describing infrasound" at Internoise '84, Honolulu, Hawaii, December 3-5, 1984

Møller, Henrik

Published in:
Journal of Low Frequency Noise, Vibration and Active Control

Publication date:
1984

Discussion of ISO/DIS 7196
"Acoustics – Methods for Describing Infrasound" at Internoise 84, Honolulu, Hawaii.

Report prepared by Henrik Mϕller.

Reprinted from: Journal of Low Frequency Noise & Vibration
Vol.4, No.1, 1985

Multi-Science Publishing Co Ltd, 42/45 New Broad Street, London EC2M 1QY.

Discussion of ISO/DIS 7196 "Acoustics – Methods for Describing Infrasound" at Internoise 84, Honolulu, Hawaii.

Report prepared by Henrik Møller.

This discussion was suggested by the Chairman of the Internoise 84 Low Frequency Noise Session, Dr. Shinji Yamada, Yamanashi University, Japan. The discussion took place after the Low Frequency Noise Session and was open to all participants in the conference. The Chairman of the discussion was Dr. Henrik Møller, Aalborg University, Denmark.

Following the Chairman's welcome and introduction, Dr. per V. Brüel, Brüel and Kjaer, Denmark, gave a few remarks on the status of the discussion. He stated that, at the time being, the proposal was sent out for discussion through the National Committees and that the official responses would be received this way, too. However, Dr. Brüel found it valuable for the Study Group that handles the proposal (ISO TC 43/SC 1 Study Group E) to know what the opinion was at this meeting and he would readily report to them in cooperation with the Chairman. (Dr. Brüel is a member of the Study Group E).

Dr. Brüel gave a short description of the Draft International Standard ISO/DIS 7196. The standard is intended to be used when describing infrasound. It contains two weighting curves that asymptotically follow straight lines from 1 Hz to 20 Hz (Fig. 1). For one curve (named G1) this line has a slope of +12 dB per octave and for the other (G2) the slope is +6 dB per octave. Both curves have a gain of 0 dB at 10 Hz. Outside the frequency range 1-20 Hz the curves are cut off with 1 pole for frequencies below 1 Hz and 6 poles (G1) or 5 poles (G2) for frequencies above 20 Hz.

The Chairman presented six questions which he wanted the audience to discuss and which could structure the debate. The items were:

1. Frequency range.
2. Slopes of curves.
3. Rate of cut-off outside the frequency range covered.
4. Reference frequency or gain.
5. Dynamic range of the ear.
6. Averaging time-constant.

1. Frequency range

The Chairman raised the question about the frequency range, because a Japanese proposal for a weighting curve covers the range 1-50 Hz and because recent research has shown that many problems traditionally attributed to infrasound actually are caused by noise in the low audio range 20-100 Hz.

Dr. Brüel agreed that it would be very nice if frequencies above 20 Hz could be covered, since frequencies from 20 to 100 Hz are insufficiently covered by the A-curve. However, he found it politically impossible to obtain support for a curve overlapping the A curve. An attempt to extend the frequency range above 20 Hz would probably lead to a rejection of the proposal.

Dr. Møller showed that the loudness curves he had measured were parallel, and parallel to the threshold curve, up to 20 Hz. Above this frequency the curves diverge. This means that a single weighting curve cannot be used at all levels if frequencies above 20 Hz are included. So besides the political reasons there are also technical and psychoacoustical arguments for only including frequencies below 20 Hz. The problems at low audio frequencies must then be solved in another way.

Dr. Robert W. Young, San Diego, California, USA, asked where Dr. Møller's curves were published and whether they were in agreement with possible similar curves measured at other laboratories.

Dr. Møller explained that the curves were published at Internoise 83 in Edinburgh and that a full paper covering details, such as the method and the standard deviations obtained, would soon appear in the Journal of Low Frequency Noise and Vibration (vol. 3 no. 2, 1984, pp. 78-87).

Only one set of curves had previously been published (L.S. Whittle, S.J. Collins and D.W. Robinson: The audibility of low frequency sounds. Journal of Sound and Vibration, vol. 21, no. 4, 1972, pp. 431-448). In that investigation 50 Hz was used as a reference, so the curves did not have a measured connection to 1 kHz. Instead, this connection was obtained from the ISO/R 226 curves. At present, there is a discussion of the reliability of the ISO curves at low frequencies and the procedure of Whittle et. al. has led

Dr. Bruel proposed an appendix showing equal loudness curves and explaining that a small change in G1 weighted level will result in a large change in sensation.

Dr. Mϕller suggested a figure showing the approximate connexion between, on the horizontal axis the G1 weighted sound level and on the vertical axis some kind of loudness or annoyance measure. The loudness or annoyance axis might or might not be calibrated in, for example, phon or PN dB.

Dr. Brüel expressed his support for this proposal.

There was a general agreement that the Standard should contain information about the narrow dynamic range of the ear at these frequencies.

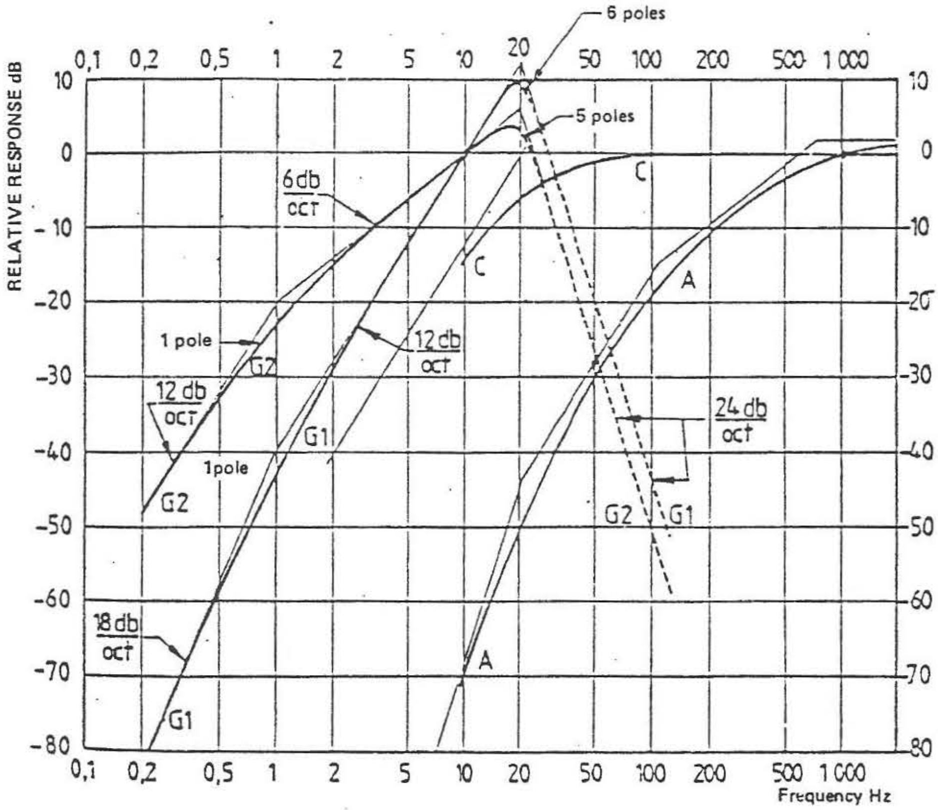

Figure 1 Frequency–weighting characteristics of G1- and G2- weighting

6. Averaging time constant

It was suggested that the time constant should be derived from the time constants used with the A curve and the frequency spacing from the A curve to the G2 curve. The low ends of these curves are much alike and spaced about a factor of 25 in frequency (Fig. 1.) As the "fast" and "slow" time constants used with the A curve are 125 ms and 1 s, respectively, this would give 3.1 s and 25 s to be used with the G2 curve.

Dr. Brüel found it sufficient to multiply the time constants by 8, resulting in 1 s and 8 s, which is also close to values used for vibration measurements in this frequency range.

Dr. Young raised the question, why two time constants were needed.

Dr. Brüel and Dr. Mϕller found it practical to have two: the short one can quickly give a value when mainly frequencies in the range 10-20 Hz are present, while the long one is needed when lower frequencies are involved and very exact values are needed. If somebody tries to use the short time constant when important lower frequencies are involved, the pointer will oscillate and thus warn the operator. The same effect occurs with the A curve, where 125 ms is too short a time constant for measurement of a 20 Hz component.

(Comment: An Annex to the proposed Standard states that a rectangular time window should be used. Because of the long settling times that would be required, use of RC type integrators is not recommended. The time window should not be less than 10 s).