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NASA TECH BRIEF

Methods for Measuring the Loudness and Noisiness of Complex Sounds

The significant increase of noise in the community, home, and office led acoustical engineers and psychologists to recommend that a method of measuring sounds in terms of their loudness be developed. As a part of this work, it was assumed that not only does a sound become more unacceptable the louder it becomes, but also that such attributes of sound as pitch and complexity interact with loudness to produce different judgments of acceptability. A review of some of the concepts and studies that brought about present methods of rating the loudness of sounds was made. A similar review of the methods for rating perceived noisiness was also made. Finally, the results of judgment tests used to validate some of the methods for estimating loudness and noisiness were reviewed (see ref.).

The findings of this review indicated that the following physical and temporal aspects of sound (listed in order of importance) influence people in their rating of subjective noisiness: (1) intensity; (2) spectrum shape and bandwidth; (3) spectral complexity (the presence of one or more tones in a band of random noise); and (4) duration. The review also showed that a variety of methods were developed for calculating the perceived noisiness of complex sounds from either one-third octave or full octave band spectra.

The general conclusions drawn from this review for broad spectra sounds with no intense pure-tone components were:

1. A graphic method of estimating loudness (in which ten graphs covering both diffuse and free field conditions are used) is probably the best of the objective methods, but it is not suitable for general engineering practice.
2. The full octave and one-third octave band objective methods for calculating the loudness or noisiness of relatively steady-state complex sounds of broadband spectra appear on an average to be about equally effective in their ability to predict the results of subjective judgment tests.
3. The objective methods that measure one value over all frequencies are usually not as efficient as those cited above in predicting subjective judgments of the loudness and noisiness of most complex steady-state sounds.

It was also concluded from this review that a pure-tone embedded in a broad background spectrum makes the composite subjectively noisier or more objectionable than would be predicted by the various objective measures. In addition, increasing the duration of a sound tends to increase its subjective noisiness.

Note:

The following documentation may be obtained from:

Clearinghouse for Federal Scientific
and Technical Information
Springfield, Virginia 22151
Single document price $3.00
(or microfiche $0.65)

Reference: NASA-CR-422 (N66-21098), Review of Research and Methods for Measuring the Loudness and Noisiness of Complex Sounds

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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