Elektrotechnik-Elektronik-Informationstechnik

EEI KOLLOQUIUM

Models of Auditory Processing and their Application to Loudness and Audio Quality Assessment

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Models of auditory processing have a variety of applications in audio engineering, including calculation of loudness and prediction of sound quality. A model of loudness developed in my laboratory has the following stages: (1) A filter to take into account the transmission of sound rom the device to the ear of the listener; (2) A filter to simulate the effects of transmission through the middle ear; (3) An array of bandpass ilters to simulate the auditory filters that exist in the cochlea of the inner ear, which are used to calculate an excitation pattern; (4) calculaion of a specific-loudness pattern from the excitation pattern. The area under the specific loudness pattern is used to calculate loudness. This odel has been adapted as an ANSI standard and will become an ISO standard. Extensions of the model allow prediction of the loudness nd audibility of one sound in the presence of another sound, and of the loudness of time-varying sounds.

The quality of an audio device, such as a mobile telephone, depends on how accurately the device transmits the properties of the sound ource to the ear(s) of the listener. Two types of "distortion" can occur in this transmission: (1) "Linear" distortion, which may be described as a deviation of the frequency response from the "target" response; (2) Nonlinear distortion, which is characterised by frequency components in the output of the device which were not present in the sound source. The perceptual effect of these two forms of distortion on sound quality can be predicted using the first three stages of the loudness model. The predictions are highly correlated with the results of subjective judgements of quality from panels of listeners.