Psychoacoustic Order Tonality Calculation

Quantifying tonalities in technical sounds according to human perception is a task of growing importance. The psychoacoustic tonality method, published in the 15th edition of the ECMA-74 standard, is a new method that is capable of calculating the perceived tonality of a signal. Other methods, such as Prominence Ratio or Tone-to-Noise Ratio do not consider several essential psychoacoustic effects. The psychoacoustic tonality is based on a model of human hearing and thus is able to model human perception better than other methods. The algorithm described in ECMA-74 calculates tonality over time and frequency. In practice, tonalities often originate from rotating components, for example, parts of an electric motor. In these cases, quantification of the tonality of orders is often more interesting than the tonality over frequency. In this paper, an extension of the psychoacoustic tonality according to ECMA-74 is presented. With this extension, it is possible to calculate the order tonalities by using the rotational speed characteristics of the measured signal in order to control the parameters of the auditory filter bank. Two of the several advantages of order-domain calculation are improved signal-to-noise ratio and spectral precision of order tonality relative to a non-synchronized filter bank.

Authors: Julian Becker, Roland Sottek

HEAD acoustics GmbH
Ebertstraße 30a
52134 Herzogenrath, Germany