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High-resolution option for the Sottek Hearing Model Tonality enables accurate order analysis

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Abstract:

The Sottek Hearing Model provides a comprehensive framework for understanding the nuances of sound perception, including such aspects as loudness, tonality, roughness, fluctuation strength, sharpness, and impulsiveness. The principal model was first published more than three decades ago as part of a doctoral thesis. Over the past few decades, the model has been refined and recently standardized in the international standard ECMA 418-2. This standard addresses several psychoacoustic parameters, including a new approach to time-varying loudness based on a nonlinear combination of partial tonal and noise loudness. This is the preferable approach because the loudness of tonal components (i.e., tonal loudness) may have a more pronounced impact on loudness perception than the loudness caused by other components (i.e., noise loudness). Other standardized parameters include tonality and psychoacoustic modulation analyses. These comprise roughness, which is employed to evaluate rapidly modulated sounds (standardized in ECMA 418-2), and fluctuation strength, which is an adapted model for slowly modulated sounds (planned for standardization in June 2025). Many practical applications in the automotive sector require order-related results to be displayed. This is challenging when considering the coarse frequency estimate typically provided due to the critical bandwidth of the auditory filters. This resolution is sufficient for psychoacoustic parameter evaluation but not as an input to an order analysis. Improvements have recently been made to the Sottek Hearing Model Tonality to provide results with a very high frequency resolution that allows for accurate order analysis. The paper describes the method and presents several application examples.

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