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Issues in the evaluation of the tonality of nonstationary sounds
containing time- varying harmonic complexes

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Nonstationary sounds that contain broadband noise and tone complexes whose fundamental frequency varies with time are encountered frequently. Aircraft flyovers and machines shifting operating speeds are examples. The tonalness of such sounds is a factor in how annoying they are. Most metrics used to quantify the tonalness of sounds have been developed for stationary sounds and are based on an analysis of spectra. Contributions from individual sinusoids are estimated and either summed or the maximum is taken. When sounds vary, spectral estimation can be problematic due to the conflicting needs to reduce the variance of the estimate, maintain high frequency resolution, and generate spectra at a rate where the varying tonal behavior can be tracked sufficiently. Harmonic complexes are often perceived holistically, having one dominant pitch, thus treating sinusoidal components independently and summing may not be appropriate. Tests conducted to analyze the tonalness of harmonic complexes in noise are described, and an analysis of aircraft flyovers is used to illustrate the issues that need to be addressed when estimating the tonalness of complex time-varying sounds.