
Abstract

An approach to the joint estimation of sine-wave amplitude modulation (AM) and frequency modulation (FM) is described based on the transduction of frequency modulation into amplitude modulation by linear filters, being motivated by the hypothesis that the auditory system uses a similar transduction mechanism in measuring sine-wave FM. An AM-FM estimation algorithm is described which uses the amplitude envelope of the output of two transduction filters of piecewise-linear spectral shape. The piecewise-linear constraint is then relaxed, allowing a wider class of transduction-filter pairs for AM-FM separation under a monotonicity constraint on the filters' quotient. The particular case of Gaussian filters is shown to yield a closed-form solution to AM-FM estimation while gammatone filters, used as a simplified model of auditory filters, and measured auditory filters, although not leading to a solution in closed-form, provide for iterative AM-FM estimation. Solution stability analysis and error evaluation are performed and the FM transduction method is compared with the energy separation algorithm, based on the Teager energy operator, and the Hilbert transform method for AM-FM estimation. Finally, a generalization to 2-D filters is described.