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Advances in the tracking of partials for the sinusoidal modeling of musical sounds

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Whereas sinusoidal modeling is widely used for sounds, polynomial models are still used for the model parameters, which can hardly handle modulations (vibrato and tremolo) present in musical sounds. Moreover, the partial tracking algorithms are often designed under stationarity assumptions.
Advances in partial tracking may come out of the modeling of the partials themselves. We consider their parameters (frequencies and amplitudes) as predictable and slow time varying: First, the future of any partial can be determined from its past evolutions; second, no audible frequency should appear in the spectral content of these evolutions, otherwise it would question the perceptive consistency of the model.
We then choose to handle non-stationary sinusoidal modeling by a deterministic approach based on linear prediction of the partial evolutions and partial discrimination based on the spectral properties of these evolutions.
The underlying model for each partial is now a sum of sinusoids, thus leading to a two-level sinusoidal modeling, well suited for musical sounds, where modulations are important. The enhanced partial tracking algorithm also handles the case of crossing partials, without the need for any probabilistic approach. Better modeling the deterministic part of polyphonic sounds leads to enhanced source separation and time scaling algorithms.