Refined IF with Application to Sparse Reconstruction

Instantaneous frequency (IF) is a key parameter for the analysis, modelling, classification and sparse reconstruction of time-varying frequency modulated signals. In our earlier studies, a robust and computationally efficient instantaneous frequency estimation method was developed and also applied to reconstruct missing sampled in a sparsely sampled signals. The algorithm worked in an iterative manner such that in each iteration the IF of the strongest signal is estimated and then removed from the mixture signal. In this study, we further improve the robustness of the algorithm. The proposed method first estimates the IF of all component using the convention iterative filtering approach. Then the IF of each component is re-estimated such that to estimate the IF of each component all the remaining components are removed from the mixture signal. This process of re-estimation is repeated till IFs between two consecutive iteration do not change or maximum number of iterations have been performed. Experimental results indicate that the proposed refinement further improves the accuracy of IF estimate and also results in improved signal reconstruction performance.

# 2 The Proposed Method

## 2.1. Instantaneous Frequency Estimation and Component Extraction Algorithm

### 2.1.1 Detection of Strongest TF point

## 2.1.2 Tracking of IF curve

### 2.1.3 Time-frequency Filtering and signal component reconstruction

(Signal reconstruction using Fourier series approximation. See Section 2.2.2 of paper titled reconstruction of gapped missing samples)

## 2.2 IF estimate Refinement

(Discussion of relax iteration)

# 3. Experimental Results

## 3.1. IF estimation Performance Comparison

Example 1: Let us consider a 3 component signal given as:



The signal compose of well separated two frequency modulated chirps that are intersected by a 3rd chirp.Figure AA illustrates the mean square error curve obtained between the original IF and the IF obtained using the proposed method and FAST-IF method. The proposed method achieves better performance.

Let us now repeat the above experiment for a scenario where two close components are intersected by a 3rd chirp. The MSE curves shown in Figure … confirm that the proposed method achieves better performance.

## 3.2. Reconstruction of Missing Samples