Data-driven Time-Frequency Analysis: A Survey

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Abstract

This is a **Tutorial** of data-driven time-frequency analysis methods.

Introduction

Non-stationary signal processing methods have developed a lot. One way is the linear time-frequency transforms that includes short time Fourier transform, wavelet transform, Stockewell transform(Stockwell, Mansinha, and Lowe (1996)) etc. A downside of linear transforms is that the atoms are fixed and predetermined. The time- frequency distribution is blurred due to the Heisenberg uncertainty principle.

One other way started in the late nineties when Huang et al. proposed the empirical mode decomposition(EMD)(Huang et al. (1998)), which extracts intrinsic mode functions from the input signal recursively using sifting processing. The EMD method has been widely used in many areas despite its shortage of a consolidate theoretical background. To overcome that difficulty, some other methods have been proposed, such as synchrosqueezing wavelet transform(Daubechies, Lu, and Wu (2011)), synchrosqueezing Fourier transform, empirical wavelet transform, singular spectrum analysis(SSA) etc.

References

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