Study of boundary conditions in the Iterative Filtering method for the decomposition of non-stationary signals

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Abstract

The decomposition of non-stationary signals is a problem of great interest from the theoretical point of view and has important applications in many different fields. For instance, it occurs in the identification of hidden periodicities and trends in time series relative to natural phenomena (like average troposphere temperature) and economic dynamics (like financial indices). Since standard techniques like Fourier or Wavelet Transform are unable to properly capture non-stationary phenomena, in the last years several ad hoc methods have been proposed in the literature. Such techniques provide iterative procedures for decomposing a signal into a finite number of simple components, called Intrinsic Mode Functions (IMFs). At this regard, we recall the well-known and widely used Empirical Mode Decomposition (EMD), an algorithm conceived in 1998 by Huang and his research team at NASA [1]. Since this strategy is empirical and lacks of theoretical foundations, recently the Iterative Filtering (IF) method has been proposed [2]. IF is based on ideas similar to EMD, but unlike EMD allows to make a mathematical analysis of method properties. In this talk we focus on investigating the use of different Boundary Conditions (BCs) in IF, which give rise to different matrix structures. The results presented are based on tools developed in the context of image restoration [3, 4]. Numerical experiments show that a suitable choice of BCs is able to improve in a meaningful way the quality of signal decomposition in IMFs computed by IF method.

References

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