Properties of Fast Framelet Transform

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The theory of classical wavelets and framelets is extensively studied in the function setting, in particular, the function space L_2; the discrete wavelet (or framelet) transform is often regarded as a byproduct of the multiresolution analysis, that is, decomposition and reconstruction of functions in L_2 via the nested subspaces of L_2 in a multiresolution analysis. However, to understand wavelets and framelets better, it is more natural and fundamental to directly study the fast framelet/wavelet transform and its properties. In this talk, we shall present a comprehensive study of framelets and wavelets using an algorithmic approach. We shall talk about the discrete framelet transform and its three fundamental properties: perfect reconstruction, sparsity, and stability. Then we shall talk about systems of framelets and wavelets in the discrete/digital setting. We shall also make the connection between framelets and wavelets in the discrete setting to the classical theory of wavelets and framelets. We shall see that framelets and wavelets can be fully understood without any use of multiresolution analysis and the function space L_2.