Wavelet Decomposition of Non-refinable Shift Invariant Spaces

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The motivation behind this work is a recently constructed family of generators of shift-invariant spaces with certain optimal approximation properties, but which are not refinable in the classical sense. We try to see whether, once the classical refinability requirement is removed, it is still possible to construct meaningful wavelet decompositions of dilates of the shift invariant space that are well suited for applications.

We discuss the notion of non-stationary superfunction wavelets and their approximation properties. We also investigate the approximation properties of non-stationary cascade wavelets.

Many of our approximation results and orders are in the $L_p$-norm, thus we work in the space domain. Only when we restrict ourselves to $L_2$, do we make use of the interplay between the space and frequency domains.