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Multiresolutions, multivariable operator theory, and representations.

We offer an operator theoretic approach to multiresolutions. This in turn is motivated by filters from signal processing; with the multiplicity in a multiresolution corresponding to the number of frequency bands in the associated filter. Multiresolutions are important, not only in wavelets, but more generally as well, because (among other things)they offer fast and efficient algorithms; and they encompass a host of other applications, for example numerical analysis and in learning theory. By now, the applications to wavelet offer a proven and sucessful alternative to classical Fourier methods, Fourier series and integrals; applied to analysis and synthesis problems. In general, with multiresolutions, one obtains recursive and computational spectral resolutions which are localized, so better adapted to discontinuities. And they offer better numerical schemes. Multiresolutions are further useful in the study of self-similarity, in the analysis of fractals, and of non-linear dynamical systems. A special case of this is illustrated by the renormalization property for scaling functions from wavelet theory.