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Random Fourier Series vs. Random Wavelet Series

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The huge success of wavelet bases was the consequence of two key properties: On one hand, the general framework of multiresolution analysis, built by Stéphane Mallat, which led to the fast decomposition/reconstruction algorithms and to the construction of compactly supported wavelets by Ingrid Daubechies; and, on other hand, the characterization of large classes of function spaces by simple conditions on wavelet coefficients, worked out by Yves Meyer (often referred to as the "multiplier property") and which had direct and practical consequences in statistics and in signal and image processing. These characterizations imply that the norm of a function is not greatly modified if its wavelet coefficients suffer perturbations, which guarantees the numerical robustness of the reconstruction of a function from its wavelet coefficients, in sharp contradistinction with Fourier series. We will expose surprising consequences of this property, which implies that the regularity properties of random wavelet series strongly differ from those of random Fourier series.

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