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Dimension functions of rationally dilated GMRAs and wavelets.

We study properties of generalized multiresolution analyses (GMRAs) and wavelets associated with rational dilations. We characterize the class of GMRAs associated with rationally dilated wavelets extending the result of Baggett, Medina, and Merrill. As a consequence, we introduce and derive the properties of the dimension function of rationally dilated wavelets. In particular, we show that any mildly regular wavelet must necessarily come from an MRA (possibly of higher multiplicity) extending Auscher's result from the setting of integer dilations to that of rational dilations. Finally, we give an example of a rationally dilated wavelet dimension function for which the conventional algorithm for constructing integer dilated wavelet sets fails. (Received January 16, 2008)