

FUNDAMENTAL PAPERS IN WAVELET THEORY

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1. Peter J. Burt and Edward H. Adelson, *The Laplacian pyramid as a compact image code*, IEEE Trans. Commun., **31** (1983), 532–540.
2. R. E. Crochiere, S. A. Webber, and J. L. Flanagan, *Digital coding of speech in subbands*, Bell System Technical J., **55** (1976), 1069–1085.
3. D. Esteban and C. Galand, *Application of quadrature mirror filters to split-band voice coding schemes*, ICASSP '77, IEEE Internat. Conf. on Acoustics, Speech, and Signal Processing, **2**, April 1977, 191–195.
4. M. J. T. Smith and T. P. Barnwell III, *A procedure for designing exact reconstruction filter banks for tree structured subband coders*, ICASSP '84, IEEE Internat. Conf. on Acoustics, Speech, and Signal Processing, **9**, March 1984, 421–424.
5. Fred Mintzer, *Filters for distortion-free two-band multirate filter banks*, IEEE Trans. Acoust., Speech, and Signal Proc., **33** (1985), 626–630.
6. Martin Vetterli, *Filter banks allowing perfect reconstruction*, Signal Processing, **10** (1986), 219–244.
7. P. P. Vaidyanathan, *Theory and design of M-channel maximally decimated quadrature mirror filters with arbitrary M, having the perfect reconstruction property*, IEEE Trans. Acoust., Speech, and Signal Proc., **35** (1987), 476–492.

*Names of authors are initialed or spelled out here as they appear on the original papers.

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1. Erik W. Aslaksen and John R. Klauder, *Continuous representation theory using the affine group*, J. Math. Physics, **10** (1969), 2267–2275.
2. A. Grossmann, and J. Morlet, *Decomposition of Hardy functions into square integrable wavelets of constant shape*, SIAM J. Math. Anal. **15** (1984), 723–736.
3. A. Grossmann, J. Morlet, and T. Paul, *Transforms associated to square integrable group representations I*, J. Math. Physics, **26** (1985), 2473–2479.

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1. Alfred Haar, *Zur Theorie der orthogonalen Funktionensysteme* [On the theory of orthogonal function systems], Mathematische Annalen, **69** (1910), 331–371. Translated by Georg Zimmermann.
2. Philip Franklin, *A set of continuous orthogonal functions*, Mathematische Annalen, **100** (1928), 522–529.
3. Jan-Olov Strömberg, *A modified Franklin system and higher-order spline systems on \mathbf{R}^n as unconditional bases for Hardy spaces*, Conf. on Harmonic Analysis in Honor of A. Zygmund, Vol. II, W. Beckner et al., eds., Wadsworth (Belmont, CA), (1983), 475–494.
4. Yves Meyer, *Principe d’incertitude, bases hilbertiennes et algebres d’operateurs* [Uncertainty principle, Hilbert bases, and algebras of operators], Seminaire Bourbaki, **1985/86**. Asterisque No. 145-146 (1987), 209–223. Translated by John Horváth.
5. P. G. Lemarié and Y. Meyer, *Ondelettes et bases hilbertiennes* [Wavelets and Hilbert bases], Revista Matematica Iberoamericana, **2** (1986), 1–18. Translated by John Horváth.
6. Guy Battle, *A block spin construction of ondelettes I*, Communications in Math. Physics, **110** (1987), 601–615.

Section IV. Precursors and Development in Mathematics: Atom and Frame Decompositions

Introduction: Yves Meyer

1. R. J. Duffin and A. C. Schaeffer, *A class of nonharmonic Fourier series*, Trans. Amer. Math. Soc., **72** (1952), 341–365.
2. Ronald R. Coifman and Guido Weiss, *Extensions of Hardy spaces and their use in analysis*, Bull. Amer. Math. Soc., **83** (1977), 569–645.
3. Ingrid Daubechies, A. Grossmann, and Y. Meyer, *Painless nonorthogonal expansions*, J. Math. Physics, **27** (1986), 1271–1283.
4. Michael Frazier and Björn Jawerth, *Decompositions of Besov spaces*, Indiana Univ. Math. J., **34** (1985), 777–799.
5. Hans G. Feichtinger and K. H. Gröchenig, *Banach spaces related to integrable group representations and their atomic decompositions I*, J. Funct. Anal., **86** (1989), 307–340.
6. Ingrid Daubechies, *The wavelet transform, time-frequency localization and signal analysis*, IEEE Trans. Inform. Theory, **39** (1990), 961–1005.

Section V. Multiresolution Analysis

Introduction: Guido Weiss

1. Stephane G. Mallat, *A theory for multiresolution signal decomposition: The wavelet representation*, IEEE Trans. Pattern Anal. Machine Intell., **11** (1989), 674–693.
2. Yves Meyer, *Wavelets with compact support*, Zygmund Lectures, U. Chicago (1987).
3. Stephane G. Mallat, *Multiresolution approximations and wavelet orthonormal bases for $L^2(\mathbf{R})$* , Trans. Amer. Math. Soc., **315** (1989), 69–87.
4. A. Cohen, *Ondelettes, analysis multirésolutions et filtres miroirs en quadrature* [Wavelets, multiresolution analysis, and quadrature mirror filters], Ann. Inst. H. Poincaré, Anal. Non Linéaire, **7** (1990), 439–459. Translated by Robert D. Ryan.
5. Wayne M. Lawton, *Tight frames of compactly supported affine wavelets*, J. Math. Phys., **31** (1990), 1898–1901.
6. Ingrid Daubechies, *Orthonormal bases of compactly supported wavelets*, Comm. Pure Appl. Math., **41** (1988), 909–996.

Section VI. Multidimensional Wavelets

Introduction: Guido Weiss

1. Yves Meyer, *Ondelettes, fonctions splines et analyses graduées* [Wavelets, spline functions, and multiresolution analysis], Rend. Sem. Mat. Univ. Politec. Torino, **45** (1987), 1–42. Translated by John Horváth.
2. Karlheinz Gröchenig, *Analyse multi-échelle et bases d'ondelettes* [Multiscale analyses and wavelet bases], C. R. Acad. Sci. Paris Série I, **305** (1987), 13–17. Translated by Robert D. Ryan.
3. Jelena Kovačević and Martin Vetterli, *Nonseparable multidimensional perfect reconstruction filter banks and wavelet bases for \mathcal{R}^n* , IEEE Trans. Inform. Theory, **38** (1992), 533–555.
4. K. Gröchenig and W. R. Madych, *Multiresolution analysis, Haar bases and self-similar tilings of \mathbf{R}^n* , IEEE Trans. Inform. Theory, **38** (1992), 556–568.

Section VII. Selected Applications

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1. G. Beylkin, R. Coifman, and V. Rokhlin, *Fast wavelet transforms and numerical algorithms, I*, Comm. Pure Appl. Math., **44** (1991), 141–183.
2. Ronald A. DeVore, Björn Jawerth, Vasil Popov, *Compression of wavelet decompositions*, Amer. J. Math., **114** (1992), 737–785..
3. David L. Donoho and Iain M. Johnstone, *Adapting to unknown smoothness by wavelet shrinkage*, J. Amer. Statist. Assoc., **90** (1995), 1200–1224.
4. Stéphane Jaffard, *Exposants de Hölder en des points donnés et coefficients d'ondelettes* [Hölder exponents at given points and wavelet coefficients], C. R. Acad. Sci. Paris Série I, **308** (1989), 79–81. Translated by Robert D. Ryan.
5. Jerome M. Shapiro, *Embedded image coding using zerotrees of wavelet coefficients*, IEEE Trans. Signal Processing, **41** (1993), 3445–3462.