

# Contents

Preface	ix
Chapter 1. Still images compression	1
1.1. Introduction	1
1.2. A first glance at compression and denoising. The supernova <i>SN1987A</i>	1
1.3. Atomic decompositions and modeling	3
1.4. Wavelets and still image compression: some success stories	8
1.5. Sampling, quantization, thresholding and compression	9
1.6. A first visit to $u + v$ models for still images	13
1.7. Best-basis algorithms in signal processing	15
1.8. The old JPEG	17
1.9. Karhunen-Loève expansions	18
1.10. An example where the Karhunen-Loève approach is ineffective: the ramp function	19
1.11. A second visit to $u + v$ image models	22
1.12. The space $BV$ of functions with bounded variation in the plane	23
1.13. The Osher-Rudin model	27
1.14. The mathematical properties of the Osher-Rudin model	30
1.15. Modeling textures	42
1.16. Wavelet shrinkage	45
1.17. Littlewood-Paley analysis	50
1.18. A survey of wavelet analysis	57
1.19. Littlewood-Paley analysis and wavelet analysis	65
1.20. Quantization issues: Fourier series vs. wavelet series	66
1.21. Fourier series vs. wavelet series: expansions of $BV$ functions	67
Chapter 2. The role of oscillations in some nonlinear PDE's	71
2.1. Introduction	71
2.2. Improved Gagliardo-Nirenberg inequalities	72
2.3. Improved Poincaré estimates	79
2.4. Wavelet coefficients of integrable functions	80
2.5. A first model case: the nonlinear heat equation	81
2.6. The Navier-Stokes equations	84
2.7. Modeling coherent structures	88
2.8. The nonlinear Schrödinger equation	91
Chapter 3. Frequency modulated signals, chirps and the Virgo program	93
3.1. Introduction	93
3.2. Hölder classes with negative exponents	96
3.3. Infinitely oscillating functions	101

3.4.	A first definition of $n$ -dimensional chirps	103
3.5.	A second definition of chirps	104
3.6.	Jaffard's criticism	105
3.7.	Chirps and two-microlocal spaces	107
3.8.	Wavelets and chirps	109
3.9.	A function proposed by Riemann contains infinitely many chirps	111
3.10.	A generalized Riemann function	114
Conclusion		117
Bibliography		119