

Contents

Introducción	1
0.1 Objectives	3
0.1.1 Specific Objectives	3
0.2 Content of the thesis	4
1 Theoretical Framework	6
1.1 Robust phenomena and out-of-equilibrium systems	6
1.2 Dynamical Systems and Evolution Laws	7
1.3 Spatially Extended Systems	7
1.3.1 Variational and Nonvariational Systems	8
1.3.2 Particle-Like Solutions	9
1.4 Fronts or domain walls	9
1.5 FKPP fronts	9
1.5.1 Propagation speed: pulled and pushed fronts	10
1.5.2 Pulled-Pushed Transition	12
1.6 Normal fronts	12
1.7 Dissipative Localized Structures	14
1.8 Patterns and localized patterns	14
1.9 Dynamical Complexity	15
1.9.1 Quasiperiodicity	15
1.9.2 Chaos	16
1.9.3 Spatio-temporal chaos	22
1.9.4 Lyapunov Exponents	22
1.9.5 Spectrum of Lyapunov Exponents	26
1.10 Chimera states	26
1.10.1 Chimera states in a discrete time system	27
1.10.2 Chimera states in a continuous time system	28
1.11 LCLV Experiment: A nonvariational setup	29
2 Nonvariational Effects in FKPP Fronts	33
2.1 Introduction	33
2.2 Nonvariational Fisher-Kolmogorov-Petrovskii-Piskunov model	33
2.3 Outlook	36
3 Nonvariational Effects in Normal Fronts	45
3.1 Introduction	45

3.2	Landau-De Gennes System	46
3.2.1	Analytical Solution and Front Speed Calculation	47
3.2.2	Nonvariational contribution to the speed	49
3.2.3	Swift-Hohenberg from Landau De-Gennes	50
3.3	2D Fronts	50
3.4	Outline	53
4	Nonvariational Effects in Localized Structures	59
4.1	Introduction	59
4.2	Propagation of localized states driven by nonvariational effects	60
4.3	Catamaran states: a 2D generalization	61
4.4	Experimental Catamarans.	62
4.5	Outline	62
5	Traveling Chimeras	71
5.1	Introduction	71
5.2	Traveling chimera states in the nonvariational Turing-Swift-Hohenberg equation	73
5.3	Position, speed, and asymmetry of chimeras	74
5.4	Traveling chimeras and bounded solutions	74
5.5	Dark traveling chimeras	76
5.6	Outline	77
6	Wandering Chimeras	88
6.1	Introduction	88
6.2	Wandering Chimeras	89
6.3	Wandering localized structures in physical experiments	91
6.4	Control of wandering motion: pinning and chaotical engines	92
6.5	Outline	93
7	Effect of Deterministic Fluctuations in Fronts Dynamics	100
7.1	Introduction	100
7.2	Deterministic versus stochastic fluctuations	101
7.2.1	Dynamical and statistical differences	102
7.3	The Nagumo–Kuramoto–Sivashinsky system	103
7.4	The effect of spatiotemporal chaos in the front propagation: a chaos-induced transition	104
7.5	Emergence of noise from chaos	106
7.5.1	Noise from Lorenz equation	108
7.5.2	Logistic Chaos	108
7.6	Obtaining a Central Limit Theorem	110
7.7	Outline	110
8	Effect of deterministic fluctuations in localized structures	123
8.1	Introduction	123
8.2	Brownian motion particle	124
8.3	Chaotic motion particle	127
8.4	Chaos-induced transitions	128
8.5	Outline	129

9 Conclusions	137
Bibliography	141