Index

Introduction, *p. i*

PART I: EARTHQUAKE DYNAMICS

1. Source dynamics and constitutive models, *p. 1*

1.1. The coseismic processes

1.2. The dynamic problem

1.3. Fracture criteria and governing models

1.4. Slip – dependent constitutive laws

1.5. Rate – and state – dependent friction laws

1.6. Are the models complete? Additional functional dependencies

2. Nucleation and dynamic propagation in 2 – D fault models, *p. 13*

2.1. Introduction to Chapter 2

2.2. Numerical models of 2 – D faults

2.2.1. The Boundary Integral Equation approach

2.2.2. The Finite Difference approach

2.2.3. Comparison between different numerical methods

2.3. Comparison between different constitutive models

2.3.1. Theoretical comparison between constitutive parameters. A first hypothesis

2.3.2. Dieterich – Ruina law versus slip – weakening

2.4. The dynamic propagation. The cohesive zone and the breakdown process

2.4.1. The reference model

2.4.2. Interpreting the traction evolution within the cohesive zone

2.5. A scaling law for the two characteristic length scale parameters

2.6. Theoretical interpretations
2.7. The nucleation phase
2.8. Discussion
Tables of Chapter 2, *p. 45*
Figures of Chapter 2, *p. 47*

3. Rheological heterogeneities, crack arrest and healing phenomena, *p. 65*
3.1. Introduction to Chapter 3
3.2. The crack model and the arrest models
3.2.1. The barrier – healing
3.2.2. The self – healing
3.3. The evolution law and the dynamic rupture growth
3.4. The direct effect of friction
3.5. The evolution law and the healing mechanisms
3.6. Discussion
Tables of Chapter 3, *p. 81*
Figures of Chapter 3, *p. 83*

4. A realistic 3 – D fault model, *p. 97*
4.1. Introduction to Chapter 4
4.2. The numerical model
4.2.1. The fault boundary conditions
4.2.2. The domain boundary conditions
4.3. The reference case
4.4. Coupling of two modes of propagation
4.5. Dependence on the absolute stress levels
4.6. Heterogeneous configurations
4.7. Discussion
Tables of Chapter 4, *p. 111*
Figures of Chapter 4, *p. 113*

PART II: FAULT INTERACTIONS

5. Fault interactions and stress triggering, *p. 133*

5.1. Introduction to Chapter 5

5.2. Key concept of fault interactions and stress triggering

5.3. Simulation strategy: the spring – slider model

5.4. Response to a step stress change

5.5. Response to a pulse stress change

5.6. The effect of the system conditions at the onset time

5.7. The adopted constitutive parameters

5.8. Stress perturbation applied during the seismic cycle: dependence on the onset time

5.9. Discussion

Tables of Chapter 5, *p. 159*

Figures of Chapter 5, *p. 161*

6. Conclusions and future works, *p. 175*

6.1. Conclusions

6.2. Future works

Appendix A, *p. 179*

Relation between the slip – weakening characteristic length and the breakdown zone time

Appendix B, *p. 181*

Definition of the misfit function

Appendix C, *p. 183*

Convergence and stability conditions for 2 – D fault models

C.1. BIE with slip – weakening law

C.2. FD with slip – weakening law

C.3. FD with rate – and state – dependent friction laws

Appendix D, *p. 189*

Correspondence between fracture energy and other parameters in different costitutive models

Appendix E, *p. 193*

A priori estimation of equivalent slip – weakening parameters

Appendix F, *p. 195*

Convergence and stability conditions for 3 – D fault model

Appendix G, *p. 197*

Slip velocity behaviour after a stress perturbation

References, *p. 199*