Contents

Preface	vii
Introduction	xi
Chapter 1. Experiments in a Representative Environment	1
	T
1.1. Mechanical set-up	1
1.2. Pulsed arc electric generator	4
1.3 Material properties	6
1.4. Measurements of radial permeability	7
1.5. X-ray tomography	9
1.6. Results on model materials	10
1.6.1. Influence of injected electrical energy	
on permeability	10
1.6.2. Influence of the number of shocks	
on permeability	12
1.6.3. X-ray scans	13
1.6.4. Evolution of the pore size distribution	15
1.7 Summary of the results on sandstone	17
1.8 Discussion	18
	10
Chapter 2 Computational Modeling of	
the Process: Principles	21
2.1. Pressure generated by the pulsed	
arc electrical discharge	22

vi Electrohydraulic Fracturing of Rocks

2.2. Mechanical modeling of rocks	
under dynamic loads.	29
2.2.1. Rate-independent damage growth	33
2.2.2. Rate-dependent damage growth	35
2.2.3 Failure and strain softening	38
2.3 Coupled effects between damage	00
and nermeability	41
24 Summary and conclusions	11
	77
Chapter 3. Validation of the Computational Model	47
3.1. Simulation of the experiments in	
uniaxial compression	47
3.2. Confined tests on hollow cylinders	52
3.2.1. Numerical results under low confinement	55
3.2.2. Numerical results under medium confinement	61
3.2.3. Numerical results under high confinement	64
3.3. Isotropic versus anisotropic permeability	67
3.4. Conclusions	68
Chapter 4. Computations on Representative	
Reservoir Geometries	71
4.1. Effect of repeated shocks	72
4.2. Simulation on a typical reservoir geometry	75
4.3. Optimization of the process	79
4.3.1. Decreasing the attenuation	80
4.3.2. Influence of the wave form	83
Concluding Remarks and Future Outlook	91
Bibliography	97
Index	103