

Contents

1 Adiabatic quantum computing	1
2 Satisfiability Problems	5
2.1 Definition of the 3-SAT problem	6
2.2 Physical description of 3-SAT	7
2.3 Algorithm Complexity	8
3 Instance Generation	13
4 Classical Simulations	19
4.1 Classical algorithms	21
4.1.1 The serial Wang-Landau algorithm	22
4.1.2 The parallel algorithm	23
4.2 Results	27
4.2.1 Energy and specific heat	27
4.2.2 Density of states	33
4.2.3 Computational complexity	36
4.2.4 Distribution Functions	39
5 Quantum Simulations	47
5.1 Quantum algorithms	50
5.2 Results	56

5.2.1	Exact diagonalization method	56
5.2.2	Lanczos method	58
5.2.3	Quantum Monte Carlo method	61
6	Conclusion and outlook	65
A	Wang Landau algorithm	69
B	Mathematica program	71