

# Index

## A

Active quantum network 40  
Adiabatic passage 14  
Adiabatic state transfer 174  
Amplitude damping 95  
Amplitude delaying channel 88  
Anderson localisation 98, 104

## B

Ballistic 15  
Beam splitter 63  
Bend 79  
Bending losses 81  
Bent chain 79  
Black box 103, 106, 124  
Bloch sphere 7  
Boundary-controlled spin chain 154, 157, 158, 160, 164  
Bragg gratings 178  
Bus topology 47, 63

## C

Centrosymmetric chain 59  
Commensurate spectrum 63  
Conclusively perfect state transfer 88  
Concurrence 9, 23  
Conditions of perfect state transfer 50, 64

Control 2  
Convergence 116  
Cosine transform 7  
Coupled chains 106  
Coupled harmonic oscillators 62  
Coupled quantum dots 63  
Coupled waveguides 63  
Coupled-mode theory 225  
Cycles 54

## D

Data buses 1  
Decoherence 95, 177, 178  
Decoherence-free subspace 96  
Design of Hamiltonians 48, 52  
Design of quantum networks 52  
Deterministic quantum computation with one quantum bit 144  
Dipolar interactions 177  
Directional coupling 71  
Disorder 98  
    absolute 162  
    diagonal 173  
    off-diagonal 173  
    relative 162  
Dispersion 88, 151, 153  
    relation 19, 150, 153  
DiVincenzo's criteria 137  
Double quantum Hamiltonian 178  
Dual channel 71  
Dual-rail 90  
Dual rail protocol 13

**E**

Efficiency 108, 109  
 Eigenstate localization 159, 162  
 Encodings 12  
 Engineered photonic lattices 234, 237, 242  
 Engineered spin chains 10, 48  
 Engineering of Hamiltonians 48, 52  
 Engineering of quantum networks 48, 52  
 Ensemble quantum computing 177  
 Entanglement 8, 139, 144  
   distillation 9, 92, 114  
   dynamics 23  
 Entanglers 1  
 Entangling two qubit gate 30  
 Experimental implementations 183  
   of state transfer 176  
 Experiments on state transfer 223, 234, 237,  
   242  
 Extractable information 125

**F**

Feedback loop 134  
 Ferromagnetic 6  
 Fidelity 6  
   of transfer 50  
 Flying qubits 2  
 Free fermions 28  
 Fully-engineered spin chain 154, 158  
 Fused silica 233

**G**

Gaussian eigenvector distribution 164  
 GHZ entanglement 139  
 Global fields 13  
 Graphs 62

**H**

Heisenberg model 129, 152  
 Heisenberg picture 124  
 Hosts 47

**I**

Implementation of state transfer 223, 234,  
   237, 242  
 Information flux 123, 126  
 Initialisation 137, 143  
 Interacting excitations 65  
 Interferometric setup 63  
 Inverse eigenvalue problem 63, 155, 160,  
   175  
 Inverted quadratic spectrum 175  
 Ising model 130, 138  
 Isotropic 6  
 Isotropic Heisenberg Hamiltonian 7  
 Iterative state transfer 178

**J**

Joint probability of failure 92  
 Jordan-Wigner transformation 30, 45, 153,  
   156

**K**

Kicks of information 136  
 Kondo model 22  
 Kondo regime 22  
 Kondo screening length 22  
 Kondo spin chains 23

**L**

Limited-control scenarios 123  
 Linear coupled-mode theory 228  
 Linear energy spectrum 163, 173  
 Linear photonic lattice 234, 237  
 Linear PST system 162  
 Localization of the quantum information 178  
 Logical topology 46  
 Logic buses 1  
 Long distance entanglement 23  
 Long distance quantum gates 28  
 Long range entanglement 21  
 Lorentzian eigenvector distribution 164

**M**

Magnetic impurity 22  
 Magnetic resonance 183  
 Manufacturing errors 152  
 Mesoscopic echo 177  
 Minimally engineered 20  
 Mirror 155  
   inversion 145  
   symmetric 29  
 Mirror-symmetric chain 59  
 Mirror-symmetric couplings 10  
 Mixed state 6  
 Momentum space 16  
 Mott insulator 32  
 Multi-rail 118  
 Multirail protocol 153  
 Multi-particle entangled 21  
 Multiple excitations 65

**N**

Nearest-neighbour interactions 59, 118  
 Near field Fresnel diffraction 29  
 Neel ordered 10  
 Network topologies 46  
 NMR 183  
 Nonequilibrium dynamics 4  
 Non-interacting excitations 65  
 Nonlinear coupled-mode theory 230  
 Nonlinear photonic lattice 242

**O**

One-way quantum computation 144  
 Operator expansion formula 127  
 Optical analogue of state transfer 234, 237, 242  
 Optical lattice 32, 43  
 Optical switch 242  
 Optimal boundary coupling 162  
 Optimized state transfer 157, 159  
 Oriented graph 127  
 Output state 6

**P**

Passive quantum network 40

Perfect state transfer 56, 57, 61, 63, 129, 137, 153, 154, 159, 160  
   condition 161  
 Perfect transfer time 165  
 Permutation 53, 59  
 Persymmetric 155  
 Perturbation strength 168  
 Perturbation theory 176  
 Phase noise 95  
 Photonic lattice(s) 84, 224, 233  
 Physical topology 46  
 Point-to-point topology 47  
 Pretty good state transfer 153  
 Primality 8  
 Problem of quantum state transfer 48

**Q**

Quadratic energy spectrum 164  
 Quadratic PST system 162  
 Quantum channel 7  
 Quantum data bus 157, 176  
 Quantum directional coupler 71  
 Quantum dot array 155, 173  
 Quantum erasure channel 92  
 Quantum error correction 174  
 Quantum gates 28  
 Quantum information processing 183  
 Quantum information transfer 151, 158, 161, 163, 165  
   robustness 159, 168, 170  
 Quantum-jump approach 96  
 Quantum network 40  
 Quantum optimal control 154  
 Quantum Rabi model 14  
 Quantum registers 2  
 Quasi-momenta 7, 17  
 Qubit network 173  
 Quench 10  
 Qutrits 108

**R**

Rate 108  
 Recurrence formulas 128  
 Registers 2  
 Resonant state transfer 167  
 Routers 21

**S**

Simulations 4  
 Single excitation 57  
 Singlet 8  
 Spectral radius 117  
 Spectral sensitivity 170  
 Spin chain(s) 2, 62, 158  
   elementary excitation 150  
   Hamiltonian 44  
 Spin-non-preserving interaction 130  
 Spin systems 183  
 Spin wave 150, 151  
 State fidelity 130  
 State transfer fidelity 161, 167  
   average 161, 168  
   scaling 168  
   time evolution 165  
 Static disorder 162, 167  
 Static qubits 2  
 Superconducting qubits 131  
 SWAP gates 40  
 SWAP operation 174, 177

**T**

Teleportation 9  
 Temporal control 136  
 Tight-binding approximation 42  
 TI model 152  
 Time control 13

Time-dependent couplings 134  
 Time-evolved operators 124  
 Time-independent Hamiltonian 127  
 Time-scale 94  
 Tomography 102  
 Tracing 6  
 Two-site operators 138, 141

**U**

Ultracold atoms 4, 31  
 Universal bus 47, 64

**W**

Waveguide 176  
 Wave packet 153, 158  
 Weak boundary coupling 157, 162, 164

**X**

XX model 127, 141, 152, 156, 160, 177  
 XXX model 152  
 XXZ model 152  
 XY chain 10  
 XY model 152  
 XYZ model 152