

Contents

1	Introduction	1
1.1	Motivation	1
1.2	Computation Models	3
1.2.1	Parallel Random Access Machine (PRAM)	3
1.2.2	Distributed Memory Machine (DMM)	4
1.2.3	Reconfigurable DMM (RDMM)	6
1.2.4	Reconfigurable mesh DMM (RM-DMM)	7
1.3	Criteria for the Quality of Simulations	8
1.4	Previous Work	8
1.4.1	Deterministic PRAM Simulations	9
1.4.2	Randomized PRAM Simulations	10
1.5	New Results	12
1.6	Organization	14
2	Basics	16
2.1	Universal Hashing	16
2.2	Majority Techniques	19
2.3	Log-Star Techniques	20
3	Direct PRAM Simulations	23
3.1	A Direct $O(\log \log n / \log \log \log n)$ Delay Simulation	23
3.2	A Lower Bound for Simple Access Protocols	33
4	Indirect PRAM Simulations	39
4.1	The Access Graph H	39
4.2	An $O(\log \log n / \log \log \log n)$ Delay Simulation	44
4.2.1	The Neighbor-Data-Structure	44
4.2.2	Schedule and Analysis of the Simulation	45
4.3	$o(\log \log n / \log \log \log n)$ Delay Simulations	47
4.3.1	The Path-Access-Structure	48
4.3.2	Cleaning Up Connected Components	52

4.3.3	An $O(\sqrt{\log \log n} \log^* n)$ Delay Simulation	53
4.3.4	An $O(\log \log \log n \log^* n)$ Delay Simulation	55
4.4	A Lower Bound for Topological Simulations	57
5	PRAM Simulations on Reconfigurable Architectures	65
5.1	Introduction	65
5.2	An $O(\log^* n)$ Delay Simulation on a Reconfigurable DMM	66
5.3	Simulation with Constant Delay on a Reconfigurable Mesh DMM	68
5.3.1	Simulation Between Reconfigurable Architectures	69
5.3.2	Analysis of the Simulation on a Reconfigurable Mesh DMM	70
6	Routing on a Complete Network	73
6.1	'All-But-Linear' Routing	73
6.2	$k - k$ Relation Routing	78
7	General tools for PRAM Simulations	85
7.1	Reduction from CRCW PRAM to EREW PRAM	85
7.2	Time-Processor Optimal EREW PRAM Simulations	87
8	Conclusions	89
A	Inequalities	91
A.1	Tail Estimates	91
A.2	Graph Theory	92
B	Reconfigurable Meshes	93
B.1	Constant Time Algorithms on Reconfigurable Meshes	93
	Bibliography	94