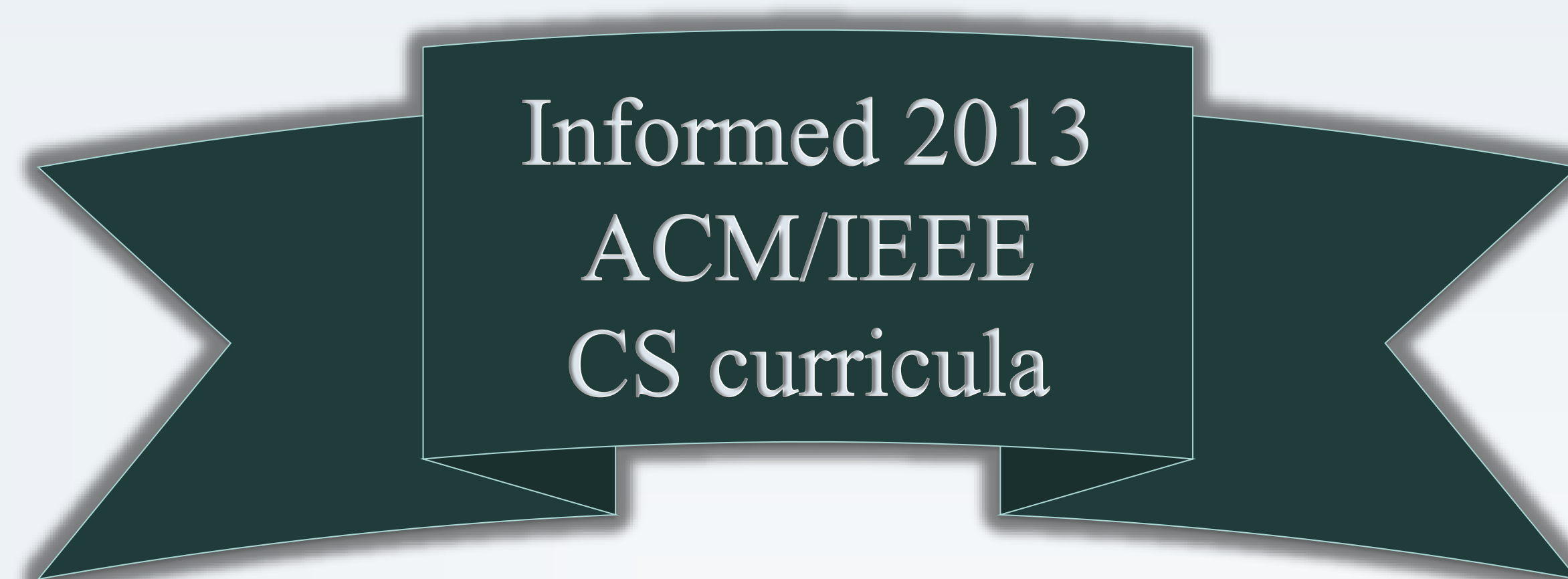


NSF/IEEE-TCPP Curriculum Initiative on Parallel and Distributed Computing - Core Topics for Undergraduates

(Version 2.0-beta)



Across all areas of parallel and distributed computing

Asynchrony
Concurrency and Dependency
Locality
Performance

Pervasive Topics

Paradigms and Notations

By Target Machine Model (SIMD, Shared/Distributed Memory, Client/Server)
By Control Statement (Threads, SPMD, Data Parallel, Accelerators)

Semantics and Correctness

Tasks/Threads, Synchronization, Concurrency Control, Memory Models

Performance and Energy

By Computation (Decomposition, Program Transformations, Scheduling/Mapping) vs. By Data (Distribution, Layout, Representation, Locality, Distributed File Systems)
Tools and Metrics (Performance Monitoring/Metrics)
Power/Energy Efficiency (Latency Tradeoffs, Load Balancing, Active/Idle power management)

Programming Topics

Classes of Parallelism
Data, Control, Pipelines, Shared/Distributed Memory
Underlying Mechanisms
Caching, Atomicity, Consistency, Coherence, Events, Handshaking, Virtualization

Architecture Topics

Algorithms Topics

Models and Complexity

Concurrency, Asynchrony, Non-determinism, Costs, Performance Metrics (speedup, efficiency, throughput, scalability), Tradeoffs, Model-based Notions (e.g., BSP)

Floating Point Representation

Range, Precision, Rounding, Error propagation, IEEE 754

Performance Metrics

IPC, Benchmarks, Bandwidth, Peak vs. Sustained
Power

Energy, Static vs. Dynamic, Clock/Power Gating

Scaling (HPC, Big Data)

Reliability, Fault Tolerance, Memory Hierarchy, Data Volume/Velocity Pressure

Algorithmic Techniques

Decomposition (Recursion, Divide & Conquer, Blocking), Load Balancing, Multi-party Communication (Reduction, Parallel Prefix, MapReduce, Synchronization), Mutual Exclusion and Conflict Resolution

Algorithmic Problems

Communication and Synchronization, Sorting, Searching, Stream Processing, Spatial Problems

