

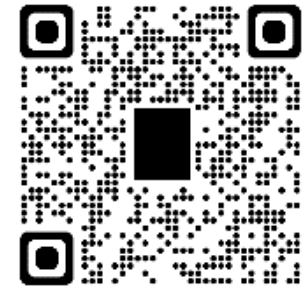
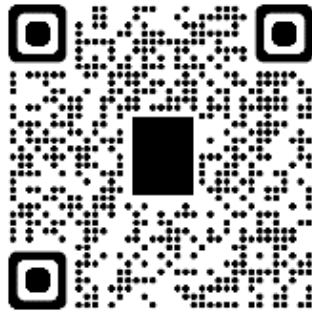
# TCPP Curriculum Initiative: Integrating Parallel and Distributed Computing in Early Computing Classes

Sushil K Prasad, UT San Antonio

Alan Sussman, U. Maryland

Chip Weems, UMass

R. Vaidyanathan, LSU



**EduHPC-24, Nov 17, Atlanta**

<https://tcpp.cs.gsu.edu/curriculum/>



Public Feedback on TCPP Curriculum & Contact

[sushil.prasad@gmail.com](mailto:sushil.prasad@gmail.com)



Sponsors

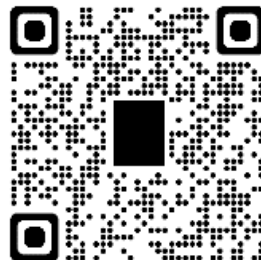


# TCPP Curriculum Initiative

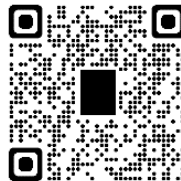
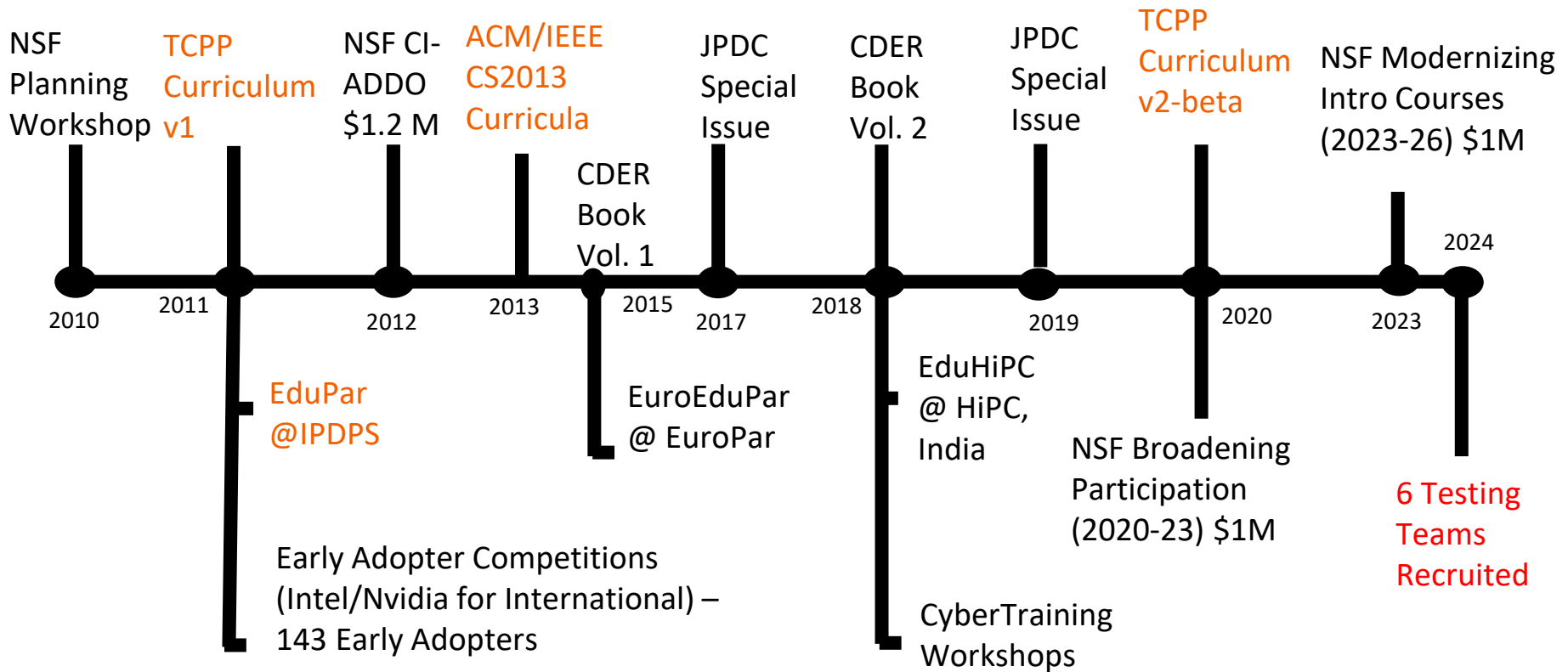
What should every Computer Science and Engineering Student know about Parallel and Distributed Computing (PDC)?

<https://tcpp.cs.gsu.edu/curriculum/>

- **Areas:** Programming, Architecture, & Algorithms
  - Version 1 – 2012
- **New Aspects:** Big Data, Energy, Distributed Computing, Pervasive topics
  - Version-2-beta released 2020
- **Companion Activities:**
  - CE-oriented TCPP Curriculum
  - Modernizing CS1/CS2 Exemplars
    - 2 Development Teams
    - Recruited 6 Testing teams
  - **CDER Book Vol 3**
    - Experience of Adopters
      - Exemplars + Resources
    - Preproposal due Nov 30



# CDER - Center for Parallel and Distributed Computing Curriculum Development and Education Resources - Timeline



# Early Adopter and Training Programs

- Over 200 early adopter and trainee institutions worldwide
  - Spring-11 - Fall-15
  - US, South America, Europe, Asia, and Middle East
- **NSF CyberTraining PDC Workshops** - Summer **2018-24**
  - UMass; Tennessee Tech; LSU
- **Additional Training workshops**
  - **SIGCSE 2023, 2024, 2025**
  - **HiPC 2022, 2023, 2024**

# Edu\* Workshop Series

- **EduPar-11** at IPDPS-2011
  - EduPar25 – May, Pittsburgh
- **EduHPC** at SC-13
  - EduHPC-24 @ SC, Atlanta
- **EduHiPC 2018 @ HiPC in India**
  - EduHiPC'24 in Bengaluru, India

# T CPP Computer Engineering Curriculum

- PDC Concepts
  - Concurrency, Asynchrony and Locality
  - Decomposition and Coordination
  - Performance and Pitfalls
- CE Courses identified
- Broad areas
  - Hardware and Architecture
  - Programming and Algorithms
  - Communications and Systems

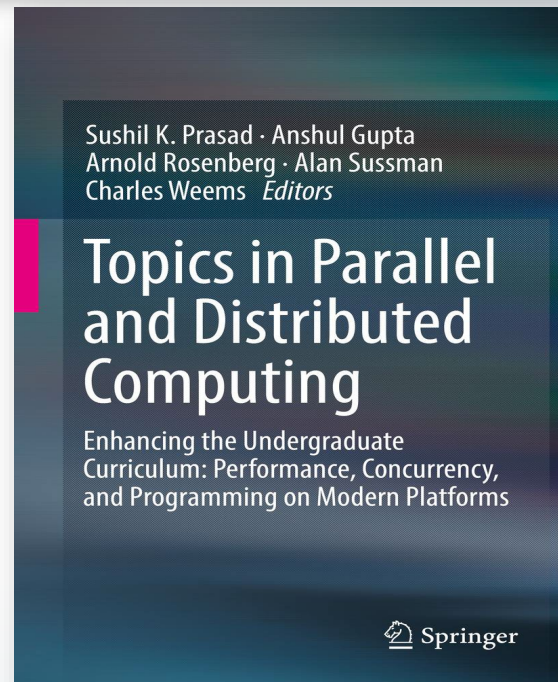
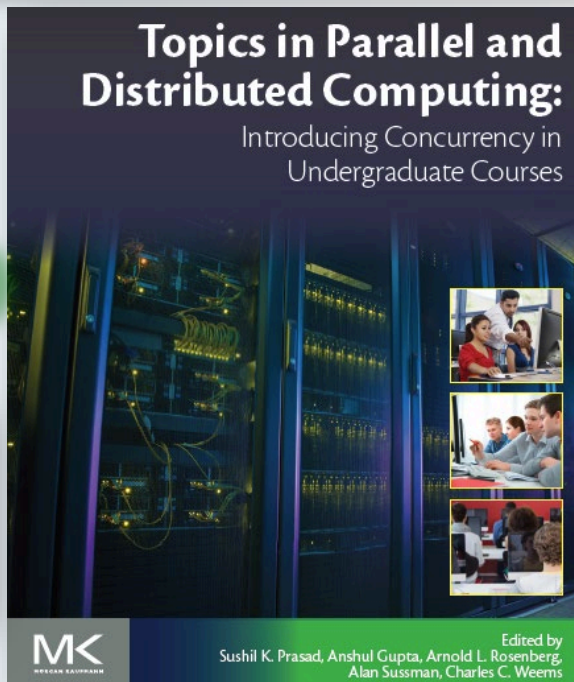
Identifying topics in lower-level courses  
in which PDC concepts can be incorporated

# NSF Modernizing CS1/CS2 Exemplar Project

- Vision: Create modern course exemplars for CS1 and CS2 courses to serve as **national models**
  - Systems are more networked, parallel, and graphical than traditional courses
  - Software uses more libraries and APIs
- **2 Development teams**
  - Knox College (Java version) and Tennessee Tech (C/C++ version)
  - Piloting CS1 this term, CS2 in the Spring
- **6 Testing Teams**
  - Casper, Hawaii Pacific U., Montclair, U. Nebraska Lincoln, U. Southern Indiana, and Webster
  - Will teach the new courses in 2025-26

50K+  
Chapter  
Downloads

Free  
Download



Free  
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**PART 1 FOR INSTRUCTORS**  
5 Chapters

- ✓ Hands-on Parallelism with no Prerequisites and Little Time Using Scratch
- ✓ Parallelism in Python for Novices
- ✓ Modules for Introducing Threads
- ✓ Introducing Parallel and Distributed Computing Concepts in Digital Logic
- ✓ Networks and MPI for Cluster Computing

**PART 2 FOR STUDENTS**  
4 Chapters

- ✓ Fork-join Parallelism with a Data-Structures Focus
- ✓ Shared-Memory Concurrency Control with a Data-Structures Focus
- ✓ Parallel Computing in a Python-Based Computer Science Course
- ✓ Parallel Programming Illustrated through Conway's Game of Life

**PART 1 FOR INSTRUCTORS**  
5 Chapters

- ✓ What do we need to know about parallel algorithms and their efficient implementation?
- ✓ Models for Teaching Parallel Performance Concepts
- ✓ Scalability in Parallel Processing
- ✓ Energy Efficiency Issues in Computing Systems
- ✓ Scheduling for fault-tolerance: an introduction

**PART 2 FOR INSTRUCTORS**  
5 Chapters

- ✓ MapReduce - The Scalable Distributed Data Processing Solution
- ✓ The Realm of Graphics Processing Unit (GPU) Computation
- ✓ Managing Concurrency in Mobile User Interfaces with Examples in Android
- ✓ Parallel Programming for Integrative GUI Applications