Parallel Computing

ECEG-6518

Introduce myself

- Fitsum Assamnew
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  - Office: 1st floor 120B
- Planned office hour
  - To be decided
  - Feel free to send me an email with anything regarding the course.

Objective

- *This module is aimed at providing students with the knowledge of parallel computing including*
  - *parallel architectures,*
  - *algorithms,*
  - *systems,*
  - *programming languages,*
  - *implementation issues*

Outline

▶ *Introduction and overview*

▶ *Models of Parallel Computers and Computation*

▶ *Technique for Designing Parallel Algorithms:*

  ▶ *PCAM technique (Partitioning, Communication, Agglomeration and Mapping)*

  ▶ *Synchronization and load balancing*

  ▶ *Message Passing Computing and MPI*

  ▶ *Distributed Shared Memory Systems and Cache coherence protocols*

  ▶ *Shared Memory*

OutLine …

- *Introduction to Multithreading:*
  - *Prefetching*
  - *Simultaneous multithreading (SMT)*
  - *chip multiprocessing (CMP)*
- *Interconnection Networks:*
  - *Hypercube*
  - *omega networks*
  - *butterfly*
- *Performance and Scalability of Parallel algorithms*
- *Current developments in parallel computers*
  - *FFT (image processing application)*
  - *butterfly network*
  - *DNA sequencing using dynamic programming*

Expected Outcome

- *The student is expected to be able to:*
  - *Understand existing parallel computing mechanisms*
  - *Use different tools for design and simulation*
  - *Read and understand research papers for professional development on parallel computing.*

Mode of Delivery

▶ *Lectures*   *30 hours*

▶ *Student project presentations*   *20 hours*

▶ *Laboratory exercises*   *10 hours*

▶ *Self study*   *120 hours*

Evaluation

- *What is on the curriculum*
  - *written (mid-semester, final) examination*   *60%*
  - *continuous assessment (assignments and project)*   *30%*
- What is proposed
  - *continuous assessment*
    - *Assignments (50%)*
      - *Summarizing 10 papers*   *10%*
      - *5 or more assignments*   *30%*
      - *Paper presentation*   *10%*
    - *Project (50%)*
      - *Proposal*   *15%*
      - *Write up (report)*   *25%*
      - *Presentation*   *10%*

References

1. *High Performance Computing, 2nd edition; by Kevin Dowd & Charles Severance; O'Reilly, 1998.*

2. *MPI - The Complete Reference, Second Edition (two volumes); by Marc Snir, Steve W. Otto, Steven Huss-Lederman, David W. Walker, and Jack Dongarra; MIT Press, 1997.*

3. *Parallel Computer Architecture - a Hardware/Software Approach; by David E. Culler and Jaswinder Pal Singh, with Anoop Gupta; Morgan Kaufmann, 1999.*

4. *Designing and Building Parallel Programs; by Ian Foster; Addison Wesley, 1994.*

5. *Concurrent Scientific Computing; by Eric F. Van de Velde; Springer-Verlag, 1994.*

6. *Introduction to Grid Computing with Globus; by Luis Ferreira et al; IBM RedBook, Dec 2002.*

7. *The Sourcebook of Parallel Computing, Edited by Jack Dongarra, Ian Foster, Geoffrey Fox, William Gropp, Ken Kennedy, Linda Torczon, Andy White, October 2002.*

8. *Programming Massively Parallel Processors with (CUDA or OpenCL)*

Let's Talk

- One more interesting book for beginners
  - An introduction to Parallel Programing by Peter S. Pacheco
  - (Thank Mr. Salessawi for suggesting it)
- **Deadlines don't change**
- Course webpage: **www.aait.edu.et/moodle**
- Tell us about your experiences and what you plan to do for your research