

## ECE 645, Computer Arithmetic Spring 2014

### Instructor

Dr. Kris Gaj  
The Nguyen Engineering Building, room 3225  
Office hours: Monday 3:00-4:00 PM, Wednesday 3:00-4:00 PM, 7:30-8:30 PM,  
and by appointment

### Lecture

Wednesday 4:30-7:10 PM, Aquia Building, room 219

### Web page

<http://ece.gmu.edu> → Courses → ECE 645

### Grading

Homework	15%
Project	35%
Midterms Exam	20%
Final Exam	30%

### Schedule (subject to possible modifications):

1. Objectives, Scope, and Organization. 01/22/2014
  2. Basic Adders and Counters. Implementation of Adders in FPGAs. 01/22/2014, 01/29/2014
  3. Carry-Lookahead and Carry-Select Adders. Hybrid Adders. 02/05/2014
  4. Conditional-Sum Adders and Parallel Prefix Network Adders. 02/12/2014
  5. Fixed-Point Representation. Endianness. 02/19/2014
  6. Floating-Point Representation. Rounding. 02/26/2014
  7. Operations in the Galois Fields. Modular Addition. Multioperand Addition. 03/05/2014
  8. Tree and Array Multipliers. 03/19/2014
  - 9. Midterm Exam. 03/26/2014**
  10. Pipelined Multipliers, Squarers, Implementation of Multipliers in FPGAs. 04/02/2014
  11. Sequential Multipliers: Part 1. Radix-2 Multipliers. 04/09/2014
  12. Sequential Multipliers: Part 2. High-Radix Multipliers. 04/16/2014
  13. Basic Dividers. Array Dividers. 04/23/2014
  14. Advanced Dividers. 04/30/2014
- Final Exam. 05/07/2014, 4:30-7:15pm**

## **Project**

Project can be done either individually or in groups of two students.

The students can choose one of the following project types:

- Hardware projects: Design and comparison of selected computer arithmetic hardware architectures using VHDL or Verilog.
- Software projects: Development of efficient software implementations of selected arithmetic algorithms in a high-level programming language.
- Analytical projects: Literature search, analysis, and comparison of various computer arithmetic algorithms and architectures.

## **Literature**

### ***Required Textbooks***

Behrooz Parhami, *Computer Arithmetic: Algorithms and Hardware Design*, 2nd Edition, Oxford University Press, New York, 2010..

### ***Supplementary Textbooks***

Jean-Pierre Deschamps, Gery Jean Antoine Bioul, Gustavo D. Sutter, *Synthesis of Arithmetic Circuits: FPGA, ASIC and Embedded Systems*, Wiley-Interscience, 2006.

Joseph Cavanagh, *Computer Arithmetic and Verilog HDL Fundamentals*, CRC Press, 2009.

Milos D. Ercegovic and Tomas Lang, *Digital Arithmetic*, Morgan Kaufmann Publishers, 2004.