

## High-level synthesis methods on FPGA-s

### 1. SYLLABUS INFORMATION

#### 1.1. Course title

High-level synthesis methods on FPGA-s

#### 1.2. University

Pázmány Péter Catholic University

#### 1.3. Semester

1<sup>st</sup> year, 1st semester

### 2. COURSE DETAILS

#### 2.1. Course nature

Pooled elective

#### 2.2. ECTS Credit allotment

5

#### 2.3. Faculty data

Dr. Nagy Zoltán

### 3. COMPETENCES AND LEARNING OUTCOMES

#### 3.1. Course objectives

The aim of the course is to give an insight to modern HLS design methodologies and systems. Students will gain experience in designing, simulating, and optimizing of algorithms and creating digital circuits using HLS system.

#### 3.2. Course contents

1. Introduction to HLS flow, binding, allocation, scheduling, control path generation
2. Overview of field programmable system-on-chip (SoC) architectures, the Xilinx Zynq architecture
3. Modeling arbitrary width data types in C/C++
4. The ARM AMBA AXI-4 bus system
5. Simulation, on-chip verification
6. Interface synthesis, interface types, control signals
7. Synthesis of arrays, array transformations, handling dependencies
8. Synthesis of loops I: Pipelining
9. Synthesis of loops II: Unrolling
10. Synthesis of functions, hierarchical designs
11. AXI DMA infrastructure IP cores
12. Hardware / Software partitioning
13. Case study I: Image processing system

14. Case study II: Smith-Waterman algorithm
15. Case study III: Solving partial differential equations

### 3.3. Course bibliography

Required reading:

Michael Fingeroff, "High-Level Synthesis Blue Book", Xlibris, 2010

Philippe Coussy, Adam Morawiec, "High-Level Synthesis: from Algorithm to Digital Circuit", Springer, 2008

Louise Crockett, Ross Elliot, Martin Enderwitz, Bob Stewart, David Northcote, "The Zynq Book Tutorials for Zybo and ZedBoard", Strathclyde Academic Media, 2015

Xilinx Vivado Design Suite User Guide: High-Level Synthesis

Xilinx Vivado Design Suite Tutorial: High-Level Synthesis

Recommended reading:

Raul Camposano and Wayne Wolf, eds., "High-Level VLSI Synthesis", Springer, 1991.

Sumit Gupta, Rajesh Gupta, Nikil D. Dutt, Alexandru Nicolau, "SPARK: A Parallelizing Approach to the High-Level Synthesis of Digital Circuits", Springer, 2004

## 4. EVALUATION

Final written and oral assessment