Undergraduate Research Project
Evolvable Mixed-Signal Hardware Engine for PSoCs

Abstract:
Many problem solutions in science and engineering have complexity that requires extensive searching in a multidimensional search space. Heuristic algorithms from the field of artificial intelligence are one approach used to search these complex mathematical surfaces. Another approach mimics nature by starting with a population of solution candidates represented as a gene string. The gene strings are then manipulated by a genetic algorithm that evaluates potential parent pairs, chooses parents based on fitness traits, and then creates new solutions by mimicking mutation and crossover genetic behavior. The goal of this project is a scalable genetic algorithm engine that is ready for use in mixed-signal programmable system-on-chip architectures.

Requirements

- scalable mixed-signal genetic algorithm engine described in VHDL
- dynamic genetic algorithm execution in-situ within the FPGA
- development of a unique genetic algorithm for evolving adaptive digital or analog filters

Deliverables

- Genetic algorithm engine design files written in VHDL
- Simulation and test plans
- Simulation and test results
- User manual
- Conference ready poster describing the work completed
- Submission of a paper to a research-oriented student or professional conference

Enrollment:

- Prerequisite: CE2930 and CS2852 with a grade of B or better
- Level: Junior or Senior standing at MSOE
- GPA: Cummulative GPA >=3.2
- Approval: EECS Department Chair

Learning Outcomes:

- Create a research project management timeline.
- Conduct a bibliometric search of the research literature.
- Describe how genetic algorithms search complex solution topographies.
- Describe the structure of a modern PSoCs and the limits it places on design.
- Develop algorithms that extend current science into new directions.
- Implement architectures as scalable circuitry in PSoCs.
- Document and present peer-reviewed research to the community.

Credits:
The student selected for this project must enroll and make acceptable progress in each of UR4981, UR4982, and UR4983. Successful completion of all three courses with grades of B or higher will result in 6 credits that will be counted as two CE technical electives.

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