





Faculty Member Contact Information

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Contact Info	
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Department	Electrical and Computer Engineering

1 Funded, 1 Unfunded URCA Assistant

	This position is ONLY open to students who have declared a major in this discipline.	M
	This project deals with social justice issues.	
	This project deals with sustainability (green) issues.	
	This project deals with human health and wellness issues.	
	This project deals with community outreach.	
	This mentor's project is interdisciplinary in nature.	I

Are you willing to work with students from outside of your discipline? If yes, which other disciplines?

- I am open to taking students outside of my discipline, but only those in similar fields.

How many hours per week will your student(s) be required to work in this position?

(Minimum is 6 hours per week; typical is 9)

- 9

Will it be possible for your student(s) to earn course credit?

- Yes; 3 credit hours of ECE 491

Location of research/creative activities:

- EB3032

Brief description of the nature of the research/creative activity?

The research for this project is to investigate different techniques and mitigations for subverting the security of computing devices. Two principle techniques are being investigated, fault injection and side channel analysis. Fault injection is a technique where erroneous signals (typically electric, magnetic, or temperature) are introduced to a computing device in an effort to surreptitiously change the normal flow of computation, usually to the attacker's desired outcome, or to induce changes in the state of memory that redirect execution flow. Fault injection is often used as a way to bypass built-in software security methods, and can potentially recover secret information such as encryption keys, or to bypass hardware access controls/hardware-based lockout mechanisms altogether, like skipping and auto-validating an authorization check. Side-channel analysis looks at hardware and software implementation irregularities (i.e. Voltage/Current fluctuations, memory access patterns, program execution timing, etc.) to recover information that a user is forbidden from accessing. The target is typically in-memory data, inaccessible to the user due to software locks like operating-system based access controls, or hardware locks, like in-processor security enclaves or external hardware security modules. Encryption keys, passwords, or other authentication/validation tokens are some examples of data that can be recovered through side-channel techniques.

The goal of the research is to attempt to create new techniques, and potentially develop novel mitigations, either hardware or software, for fault injection/side-channel analysis on computing devices.

Brief description of student responsibilities?

The student will be working primarily in an electronics lab, and will be utilizing microcontrollers and/or Field-Programmable Gate Arrays (FPGAs) to implement various fault injection and side-channel attacks against selected devices. The student will also help develop additional external hardware circuitry to facilitate the attacks, and help with potential mitigations.

URCA Assistant positions are designed to provide students with *research or creative activities* experience. As such, there should be measurable, appropriate outcome goals.

What exactly should your student(s) have learned by the end of this experience?

- Students will gain in-depth knowledge of hardware based security mechanisms, computer architecture, cryptography, and signal processing.
- Students will enhance their knowledge of hardware debugging techniques
- Students will gain experience with C (or Rust) programming, Verilog, and reconfigurable logic using FPGAs

Requirements of Students

If the position(s) require students to be available at certain times each week (as opposed to them being able to set their own hours) please indicate all required days and times:

- There are no required times, any meetings will accommodate the student

If the location of the research/creative activities involves off campus work, must students provide their own transportation?

- N/A

Must students have taken any prerequisite classes? Please list classes and preferred grades:

- CS286, ECE381, or ECE483, while not required, would be useful

Other requirements or notes to applicants:

- None