



**ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΕΙΡΑΙΩΣ
ΤΜΗΜΑ ΠΛΗΡΟΦΟΡΙΚΗΣ
ΠΜΣ ΚΥΒΕΡΝΟΑΣΦΑΛΕΙΑ
ΚΑΙ ΕΠΙΣΤΗΜΗ ΔΕΔΟΜΕΝΩΝ**

**MSc CYBERSECURITY
AND DATA SCIENCE**

**DEPT OF INFORMATICS
UNIVERSITY OF PIRAEUS**

Track: Infrastructure and Systems Security and Reliability (ISSR)

2nd semester

<https://cybersecdatasci.cs.unipi.gr>

Courses



- CDS204: **Software Security**
- CDS205: **Hardware Security**
- CDS206: **Embedded Systems Reliability**

6-ECTS course (10 lectures)

CDS205: Hardware Security

➤ Syllabus:

- **Introduction to Hardware Security. Secure embedded systems**
- **Side channel analysis attacks:** power and electromagnetic analysis
- **Fault injection attacks:** voltage and clock glitches
- **Hardware attack countermeasures:** (a) fault injection: hardware and time redundancy, error detection codes (b) side channel analysis: hiding and masking based techniques
- **Physically Unclonable Functions (PUF):** Categories, evaluation and tradeoffs

➤ Lab hours:

- **MCU development boards**
- **Labs on Fault Injection attacks and Side Channel Analysis attacks.**
- **Evaluation of secure embedded systems implementations. Countermeasure design.**

➤ Instructors

- Prof. Athanasios Papadimitriou



CDS206: Embedded Systems Reliability

► Syllabus:

- **Hardware fault tolerance:** Fault detection and masking techniques (e.g. triple modular redundancy)
- **Information redundancy:** Error detection and correction codes
- **Fault tolerance for embedded microprocessors:** SIHFT, Lockstep, checkpointing, watchdog timers
- **Fault tolerance for FPGAs:** TMR, configuration memory scrubbing
- **Radiation effects in embedded systems:** SEEs, SEUs, SEFIs, Latchup, etc.
- **Fault injection techniques for reliability analysis:** simulation-based, FPGA-based emulation

► Lab hours:

- **FPGA development boards** (Zybo)
- **Commercial FPGA design tools** (Xilinx Vivado, Synopsys) for design and automation of fault tolerance techniques: Isolation Design Flow (IDF), Local and distributed TMR, resilient FSM coding, embedded memories with ECC, Configuration memory scrubbing
- **Open-source fault injection platform** for reliability analysis under radiation-induced errors
- **Multiple projects on fault tolerant FPGA designs. Examples:** Reliably FSM design, Reliability/availability analysis of a DMR cryptographic engine for a 3-year LEO mission, TMR MCU and reliability evaluation using fault injection

► Instructors

- Prof. Mihalis Psarakis, Dr. Dimitrios Agiakatsikas

