Next Generation Chip Designers
Why, What and How

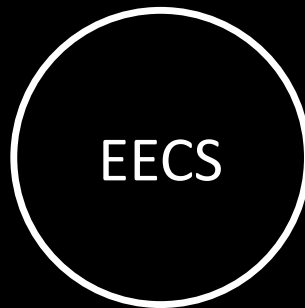Jan Madsen , Professor, DTU Compute
MPSoC'24 Megéve, France

Why
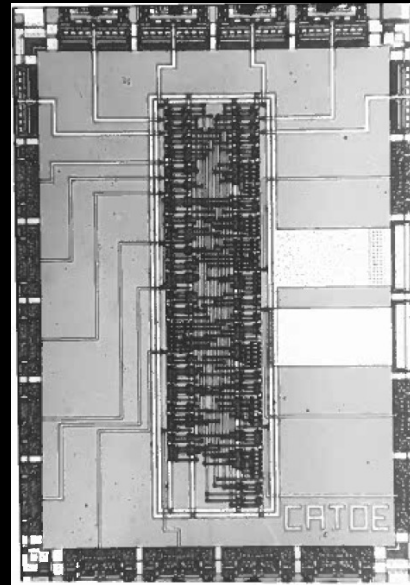
Chip Acts – US, EU, Japan

Chips Acts and initiatives, have similar targets

- Research and innovation in the design and manufacturing of advanced chips
- Increasing chip manufacturing capabilities and capacity
- Semiconductor supply chain monitoring, security, and resilience
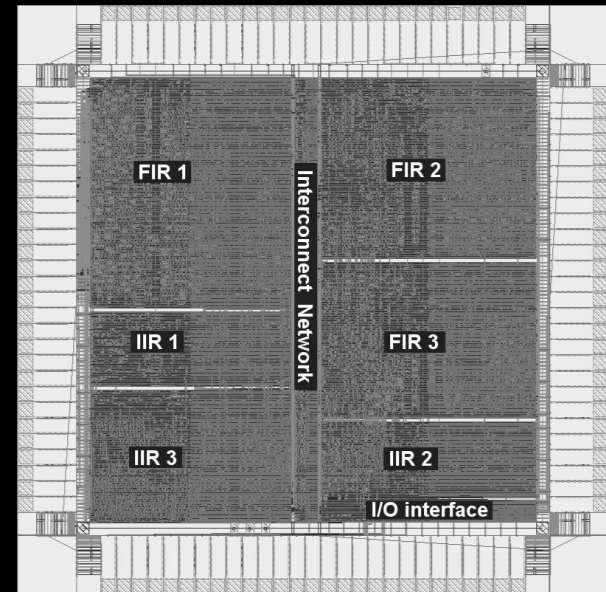- Education, skills, and workforce development.
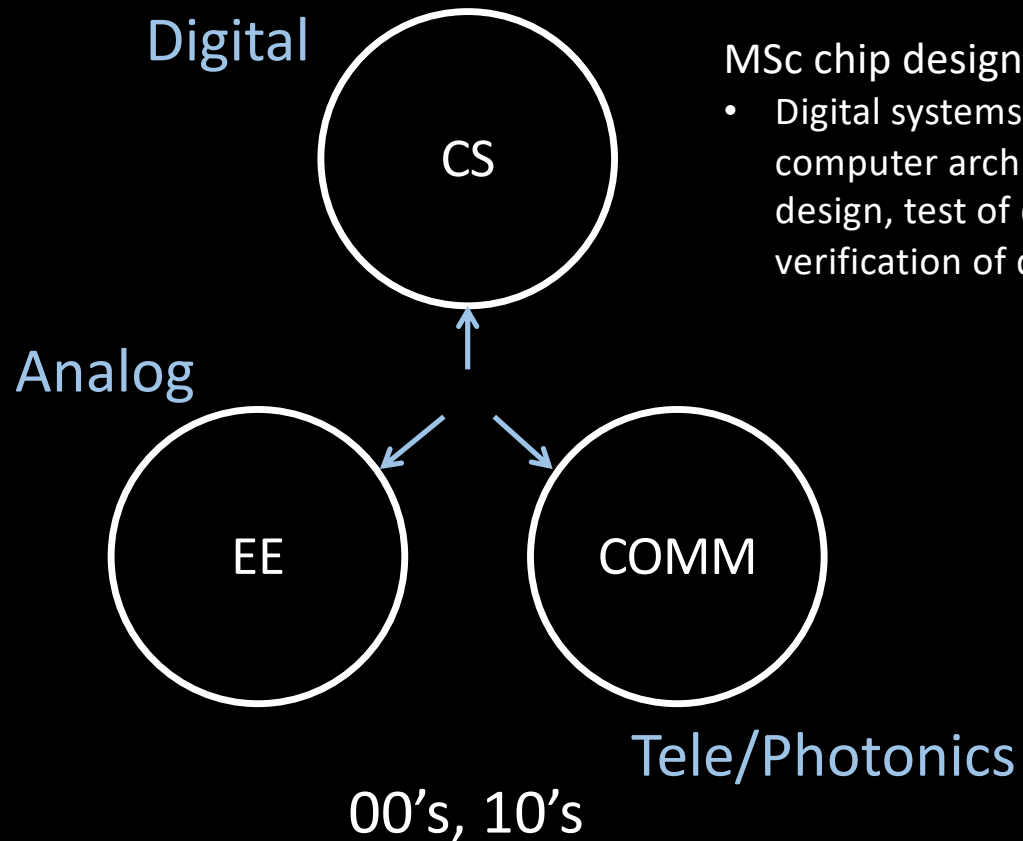
50 years of chip design

EECS

80's, 90's

1989 EDA-based chip

1999 multicore chip

FIR 1   FIR 2
Interconnect Network
IIR 1   FIR 3
IIR 3   IIR 2
I/O interface

50 years of chip design

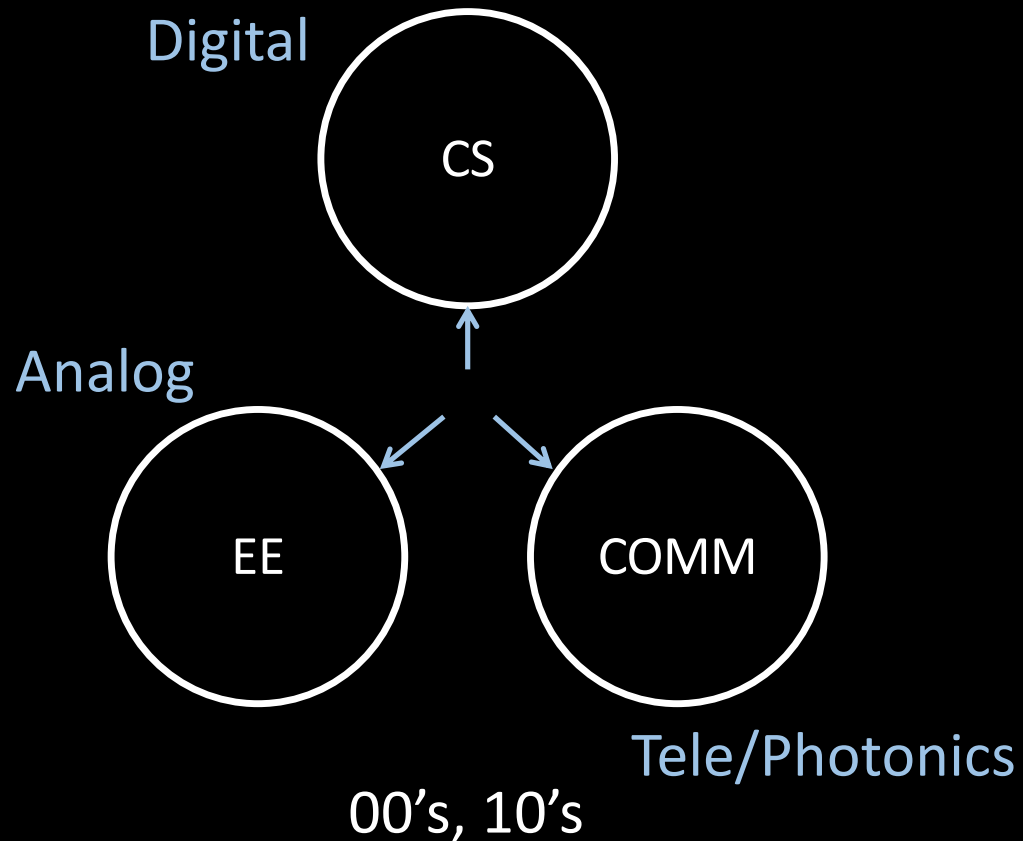Digital

CS

Analog

EE

COMM

Tele/Photonics

00's, 10's

MSc chip design specialisation
- Digital systems design, advanced computer architecture, VLSI design, test of digital systems, verification of digital systems
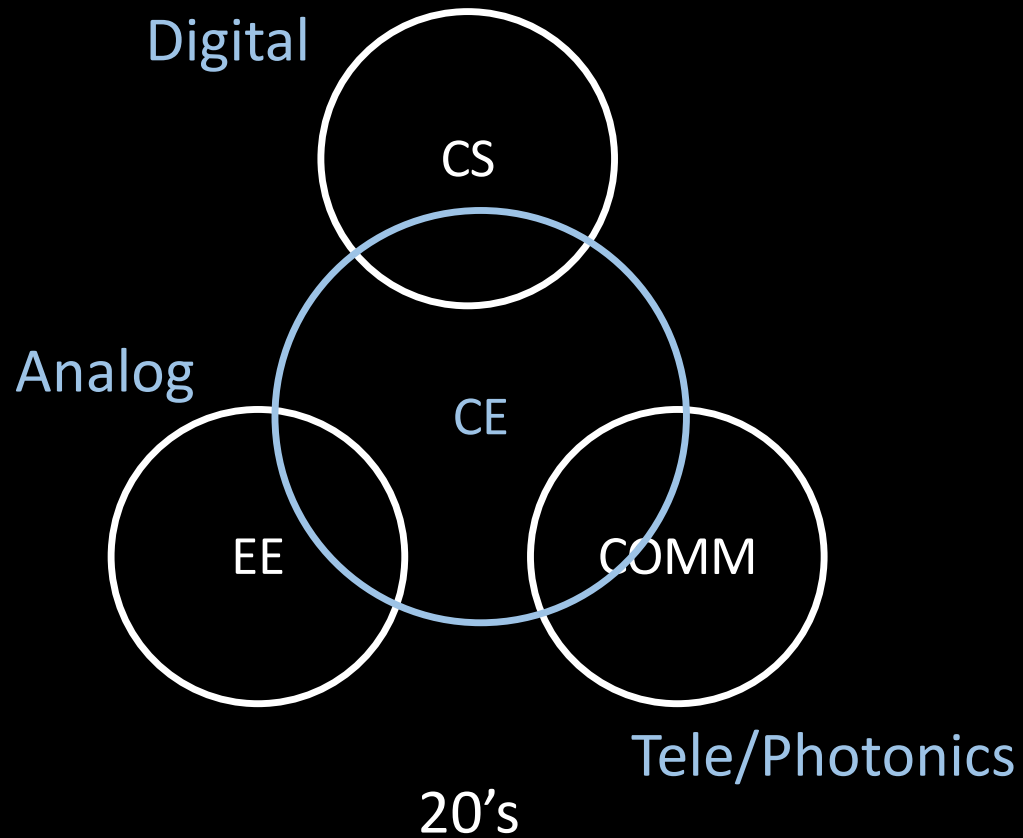

2012 NOC-based chip
Oticon

50 years of chip design

Digital

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00's, 10's

Industry	Company	Digital	Analog	FPGA/ASIC/IP
Network / Communication	Comcores	X		IP
	Microchip	X		ASIC
	Napatech	X		FPGA
	Nvidia	X	X	ASIC
	Zeuxion			IP
Audio / Hearing	Demant	X	X	ASIC
	GN	X	X	ASIC
	Infineon	X	X	ASIC
	Knowles	X	X	ASIC
	WSA	X	X	ASIC
EDA / Consultancy	Cadence	X	X	ASIC
	Synopsys	X	X	ASIC/FPGA
	SyoSil	X		ASIC
	Skycore		X	ASIC
	Presto	X	X	ASIC

50 years of chip design

Digital

CS

Analog

CE

EE

COMM

Tele/Photonics

20's

| Industry	Company	Digital	Analog	FPGA/ASIC/IP
Network / Communication	Comcores	X		IP
	Microchip	X		ASIC
	Napatech	X		FPGA
	Nvidia	X	X	ASIC
	Zeuxion			IP
Audio / Hearing	Demant	X	X	ASIC
	GN	X	X	ASIC
	Infineon	X	X	ASIC
	Knowles	X	X	ASIC
	WSA	X	X	ASIC
EDA / Consultancy	Cadence	X	X	ASIC
	Synopsys	X	X	ASIC/FPGA
	SyoSil	X		ASIC
	Skycore		X	ASIC
	Presto	X	X	ASIC

What

BSc in Computer Engineering

- Three specializations:
  - **Chip design**: with focus on digital hardware design, computer architecture, and chip technology.
  - **Embedded systems**: with focus on microcontroller programming, real-time systems, and resource constraint computing.
  - **Computer systems**: with focus on high-performance, parallel, and distributed systems.

CE: Philosophy

- Balance theory and practice
- Open source tools
  - Chisel (HDL)
  - RISC-V
- Agile hardware development
- Design and verification
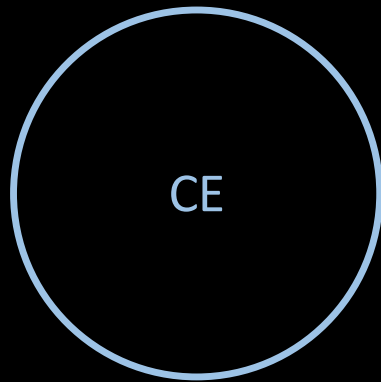- AI as a driver – Embedded/Edge AI

CE: Chip design
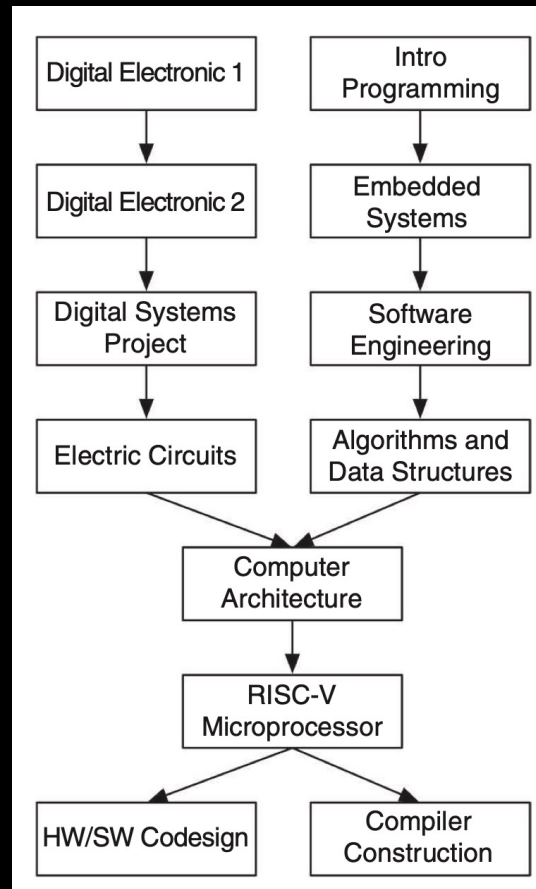
How

Computer Engineering Education

2022

CE

Computer Engineering Education

Marilyn Wolf, University of Nebraska-Lincoln

Computer engineering is a rapidly evolving discipline. How should we teach it to our students?

This virtual roundtable on computer engineering education was conducted in summer 2022 over a combination of email and virtual meetings. The panel considered what topics are of importance to the computer engineering curriculum, what

GREG BYRD: Computer engineering equals the design and analysis of computing hardware and software, both individually and as components in a system.

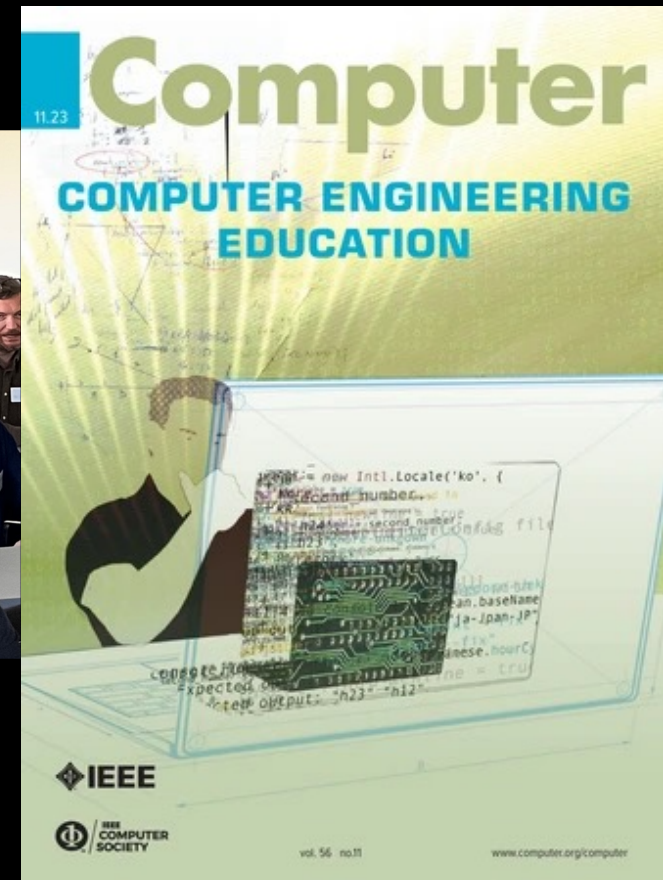**ROBERT DICK:** Yeah. It necessarily spans algorithms and physical implementation substrates. As for another possible definition, just the facts: design, analysis, and implementation of computer systems Where it's going: creating easy-to-use computer systems that help people by automating mundane tasks, organizing and sharing information, connecting them

Computer Engineering Education

DTU Chip Day

# Computer Engineering Education

2023

DTU Chip Day

Chip Design Workshop – Tiny Tapeout

- 80 participants, 40 chip designs submitted for fabrication

- DTU Chip Group (Compute, Electro and Space)

- Edu4Chip Summer school

- Chip design camps and workshops for High School students

- Newly funded Chip JU research projects

- New courses in chip design addressing the open-source toolchain and agile development
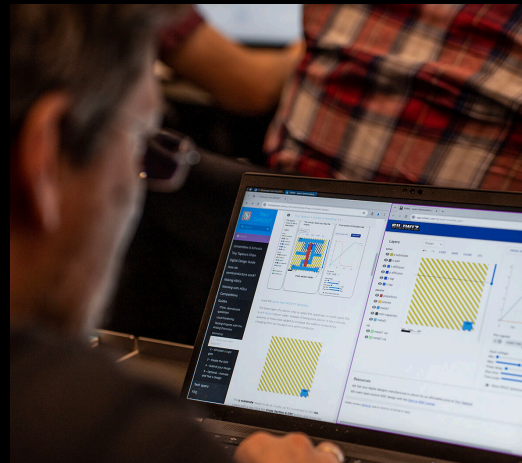
The Edu4Chip Project
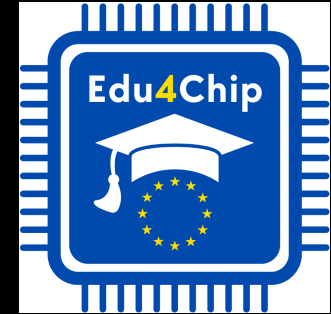
- EU-funded project
- Aims:
  - Improve our MSc education in chip design
  - Harmonize chip design education between universities
  - Supports building of new courses (4 new courses within the project)
- DTU + SyoSil, TUM, TAU, KTH, IMT, MINRES, Logicqworks, Fraunhofer
- Edu4Chip summer schools on Chip Design
  - 1st one at DTU this August: 260 applied for around 50 positions
  - 2026 in IMT (France), 2027 in TAU (Finland)

Summary

- The industry needs about 20 chip design engineers each year

- We have a strong education in (digital) chip design
  - New BSc in Computer Engineering
  - Enhanced digital design specialization with Edu4Chip

- Research is on architecture, not on (backend) chip design

- We are pushing for EC projects in Chips JU
  - Two starting (Rigoletto and NeAIxt), one submitted

Thank you