

date: 2024-01-06

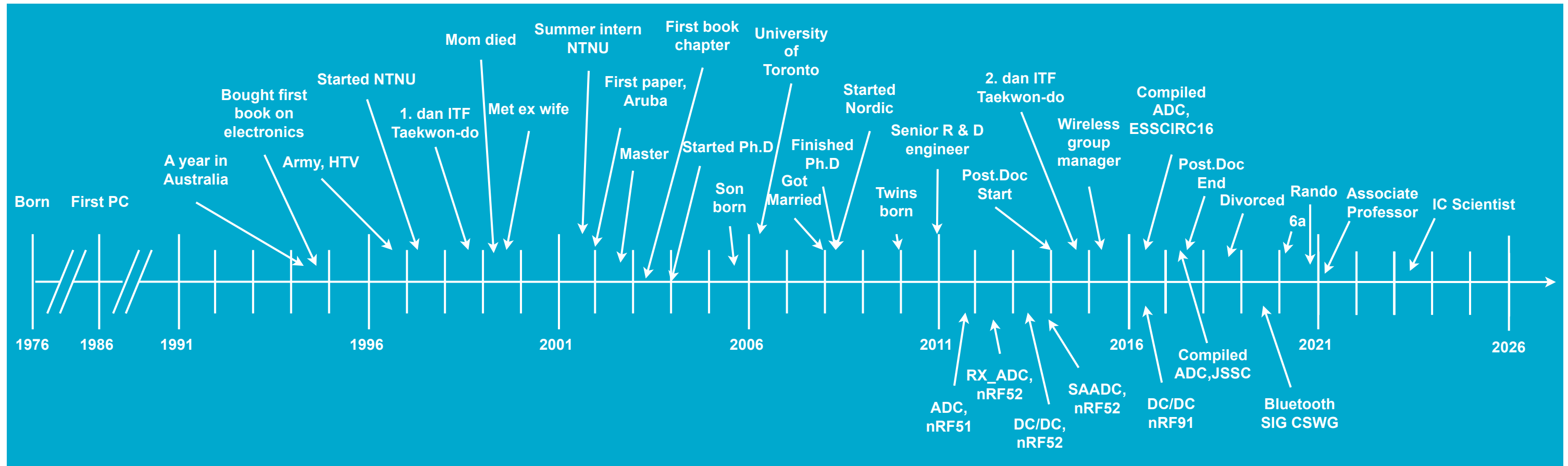
TFE4188 - Advanced Integrated Circuits

Lecture 1 - Introduction

<https://analogicus.com/aic2024>

Whno

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Teaching assistant

- Jonathan Sæthre Ege

Why

I want you to learn the skills necessary to make your own ICs

Insights · Tech The Future

The World Is Analog

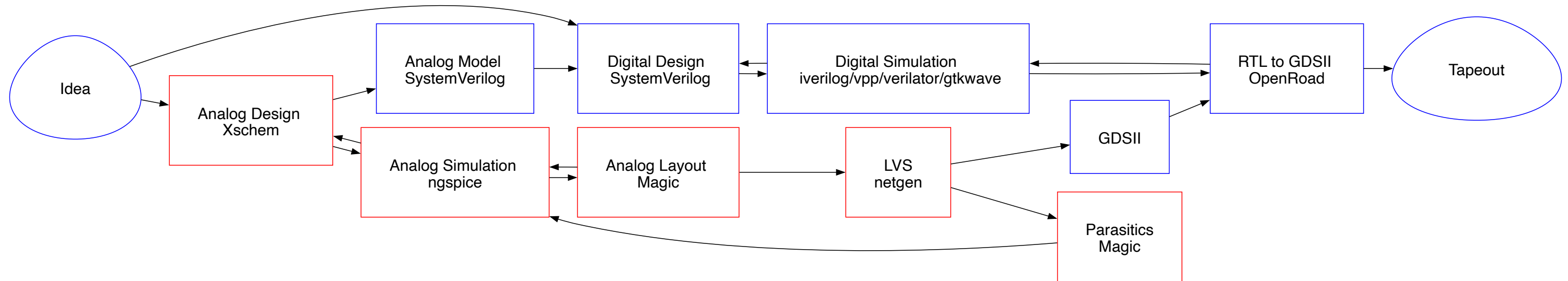
10/28/2014



Written by [Peter Kinget](#)

The world we live in is analog. We are analog. Any inputs we can perceive are analog. For example, sounds are analog signals; they are continuous time and continuous value. Our ears listen to analog signals and we speak with analog signals. Images, pictures, and video are all analog at the source and our eyes are analog sensors. Measuring our heartbeat, tracking our activity, all requires processing analog sensor information.

<https://circuitcellar.com/insights/tech-the-future/kinget-the-world-is-analog/>



Will you tape-out an IC?

- *Project flow support:* **Confluence**, JIRA, risk management (DFMEA), failure analysis (8D)
- *Language:* **English, Writing English (Latex, Word, Email)**
- *Psychology:* Personalities, convincing people, presentations (Powerpoint, Deckset), **stress management (what makes your brain turn off?)**
- *DevOps:* **Linux**, build systems (CMake, make, ninja), continuous integration (bamboo, jenkins), **version control (git)**, containers (docker), container orchestration (swarm, kubernetes)
- *Programming:* Python, Go, C, C++, Matlab Since 1999 I've programmed in Python, Go, Visual BASIC, PHP, Ruby, Perl, C#, SKILL, Ocean, Verilog-A, C++, BASH, AWK, VHDL, SPICE, MATLAB, ASP, Java, C, SystemC, Verilog, and probably a few I've forgotten.
- *Firmware:* signal processing, algorithms
- *Infrastructure:* **Power management, reset, bias, clocks**
- *Domains:* CPUs, peripherals, memories, bus systems
- *Sub-systems:* **Radio's, analog-to-digital converters, comparators**
- *Blocks:* **Analog Radio**, Digital radio baseband
- *Modules:* Transmitter, **receiver**, de-modulator, timing recovery, state machines
- *Designs:* **Opamps, amplifiers, current-mirrors**, adders, random access memory blocks, standard cells
- *Tools:* **schematic, layout, parasitic extraction**, synthesis, place-and-route, **simulation**, (System)Verilog, **netlist**
- *Physics:* transistor, pn junctions, quantum mechanics

Find a problem that you really want to solve, and learn programming to solve it. There is no point in saying "I want to learn programming", then sit down with a book to read about programming, and expect that you will learn programming that way. It will not happen. The only way to learn programming is to do it, a lot.

— *Carsten Wulff*

s/programming/analog design/ig

Zen of IC design (stolen from Zen of Python)

- Beautiful is better than ugly.
- Explicit is better than implicit.
- Simple is better than complex.
- Complex is better than complicated.
- Readability counts (especially schematics).
- Special cases aren't special enough to break the rules.
- Although practicality beats purity.
- In the face of ambiguity, refuse the temptation to guess.
- There should be one **and preferably only one** obvious way to do it.
- Now is better than never.
- Although never is often better than *right* now.
- If the implementation is hard to explain, it's a bad idea.
- If the implementation is easy to explain, it may be a good idea.

My Goal

- Enable you to read the books on integrated circuits
- Enable you to read papers (latest research)
- Correct misunderstandings on the topic
- Answer any questions you have on the chapters

Plan

Lectures:

Friday at 08:15 - 10:00

Read the introduction before the lectures at [aic2024](#)

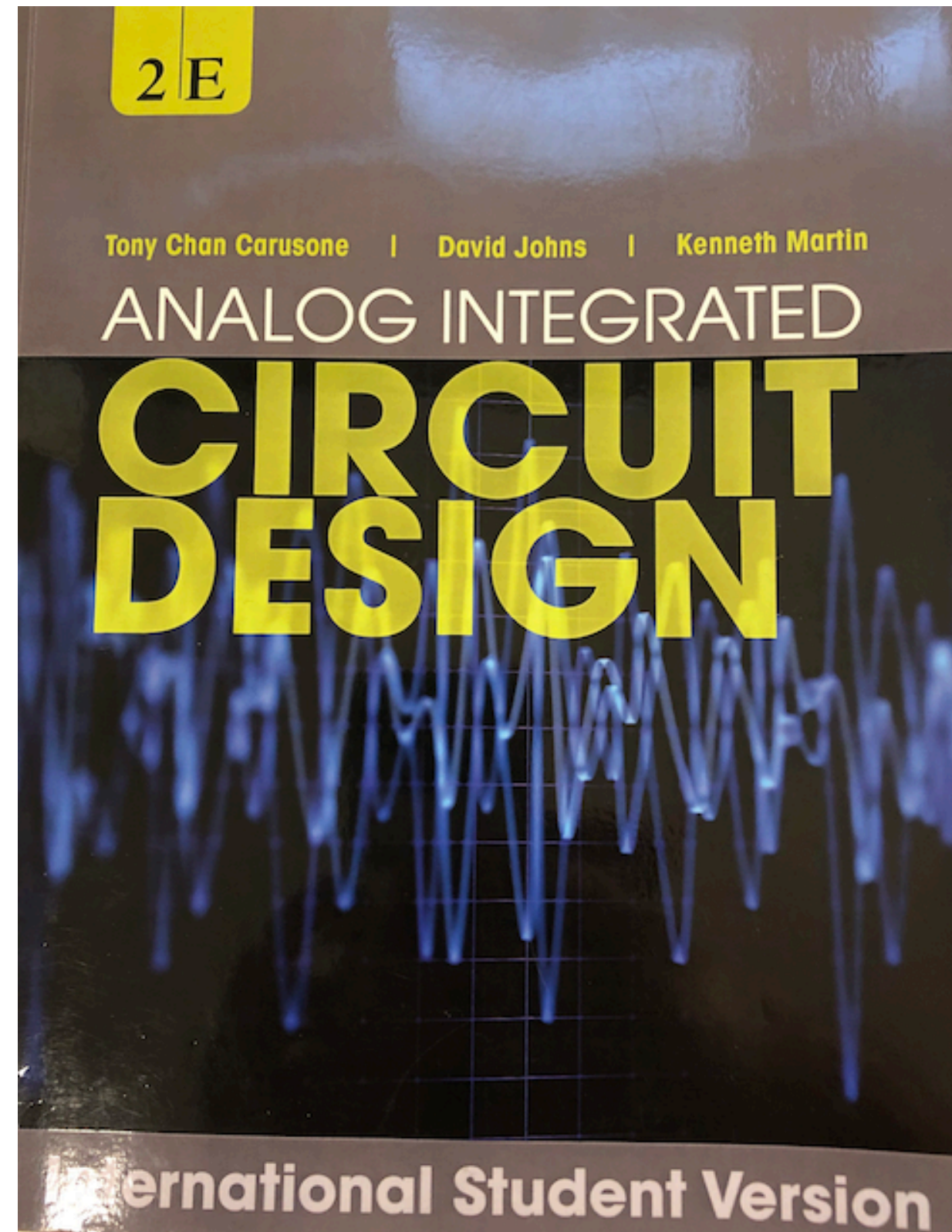
The "lectures" will be Q & A's on the topic. If no questions, then I'll ramble on.

Project Hours:

Friday at 10:15 - 12:00

The TA will be in the "project hours", and I will join most days.

- Description
- Time schedule
- Lecture plan
- Syllabus
- Youtube Videos



Exam

- June 2022
- 4 hours
- A - F grade (F = Fail)
- Counts for 55 % of the grade

Time to take responsibility for your own future

Exercises

- Exercises on blackboard now
- Solutions on blackboard after the deadline
- **One compulsory exercise: Exercise 0 - Skywater 130nm tutorial**
- For the rest, two options:
 - Don't do the exercises, don't get feedback
 - Do the exercises, hand them in within deadline, get feedback
- The TA will only support the exercises in the marked weeks

Project

Counts for 45 % of the grade

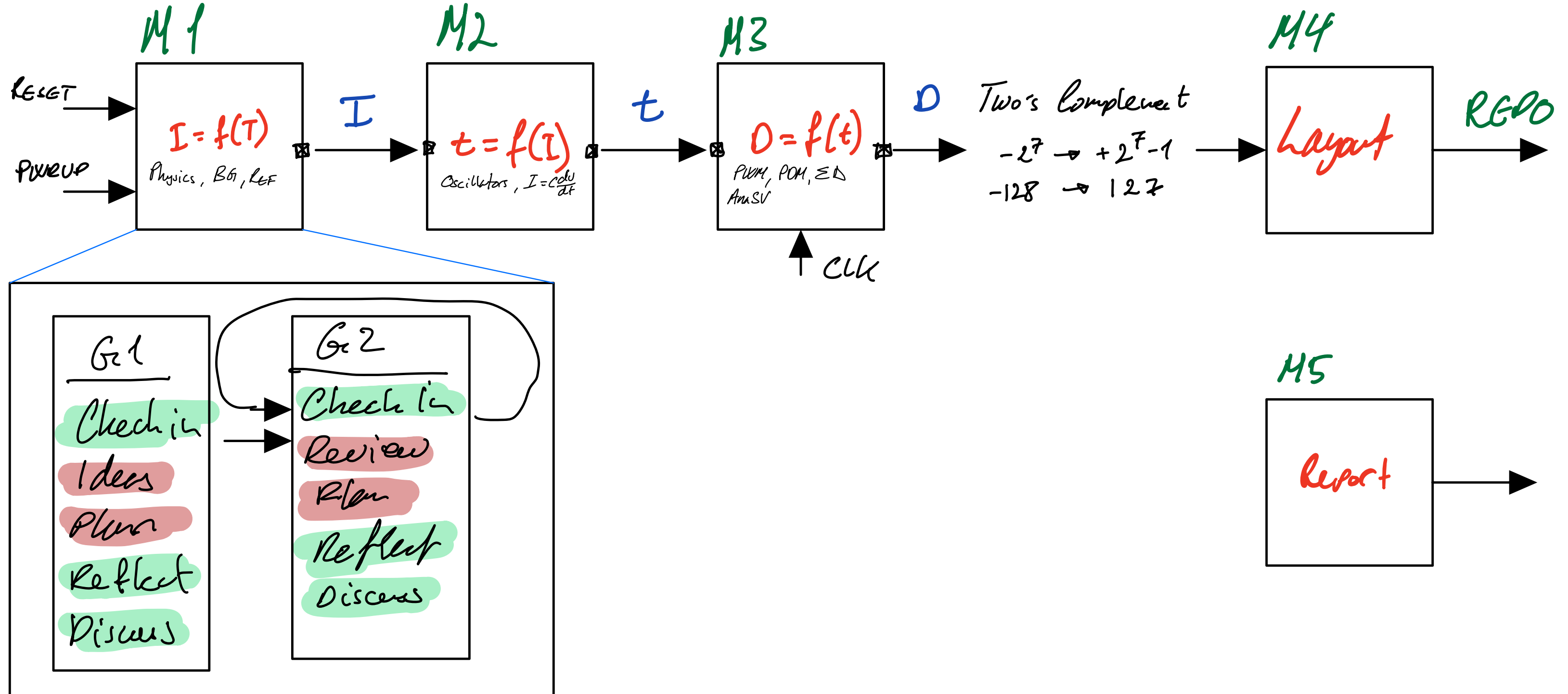
No exam without project.

Strict deadline 29 of April. If you hand in 30 of April at 00:00:01, then you fail the course.

CNR (2024)

"In an insane world, it was the sanest choice." - Sarah Connor,
Terminator 2: Judgment Day

Design a integrated temperature sensor with digital read-out



Grading

Software

Open source software (xschem, ngspice, sky130B PDK, Magic VLSI, netgen)

Skywater 130 nm Tutorial

aicex

Lower your expectations on EDA software

Expect that you will spend at least 2π times more time than planned (*mostly due to software issues*)

Questions

Do

- google
- ask a someone in your class
- use the "øvingstime and labratorieøvelse" to talk to teaching assistants and hopefully me. Don't ask about future exercises
- come to the office (B311)

Thanks!