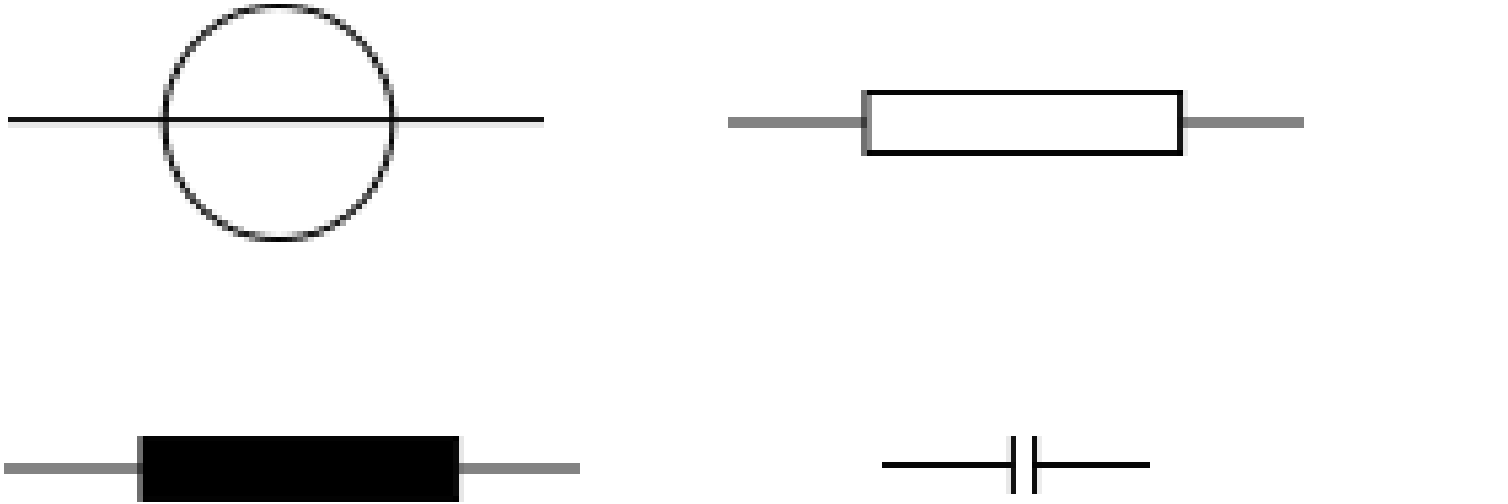
Welcome to Electrotechique-II MICRO-101

I.-C. Benea-Chelmus



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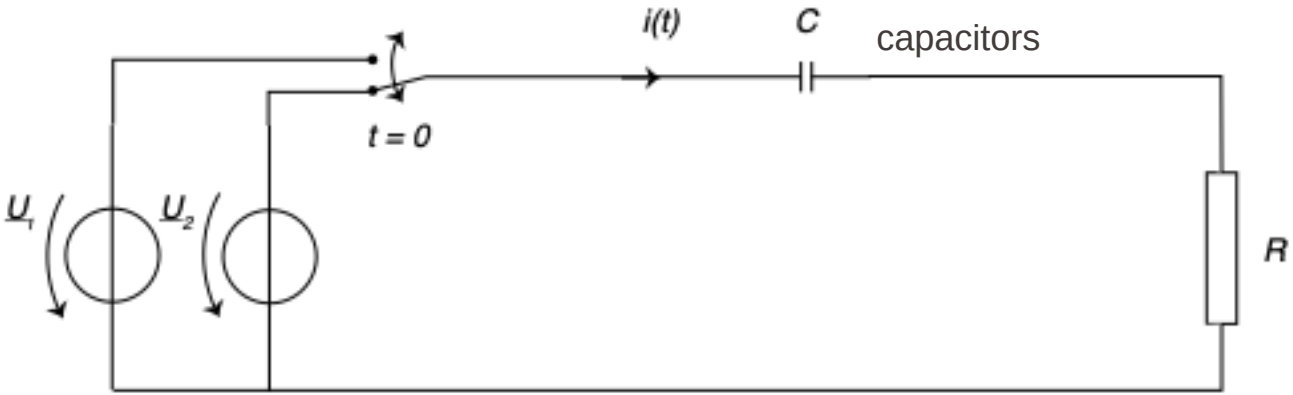


Control over

- ✓ The frequency-behavior
- ✓ The time-behavior
- ✓ The magnitude

Today

- Introduction:
  - Why should we care about electronic circuits?
  - What is this course about?
- Organisational things:
  - Syllabus and moodle
  - Exercise classes, lab session, and exam
- Recap MICRO-100

Poll students

- Why interested in this class? What are you hoping to learn?

- Which concepts of MICRO-100 were difficult to understand?

Course overview

I.-C. Benea-Chelmus

This course gives an introduction to basic electronic circuits made from lumped elements and voltage/current sources.

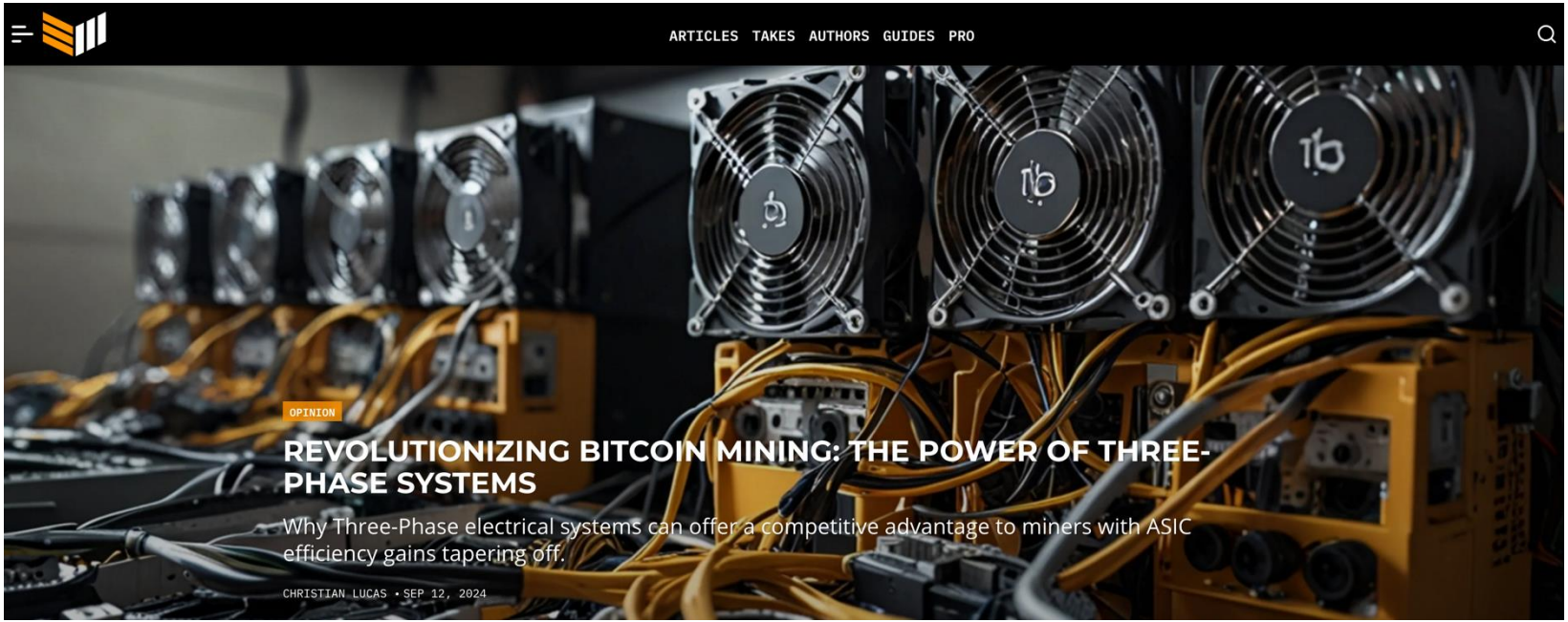
The vision

There is no stupid questions. You’re here to learn, and I don’t judge.

We’ll try to also get an intuitive understanding about the systems we’ll study. But this is a difficult task, so ask questions whenever something is not clear.

There is no stupid question.

Electronic circuits in the news:



Need for more energy-efficient power transfer to end-users.

https://bitcoinmagazine.com/technical/revolutionizing-bitcoin-mining-the-power-of-three-phase-systems

Electronic circuits in your pocket:

RF choke

Selectively blocks passage of high-frequency signals (currents) and allows low-frequency ones.
Where is this useful?

The vision

The skill lies in understanding working principle of the most basic components and so that you then can imagine more complex systems, based on these components to benefit an application of choice.

Because, after all, we're engineers and want to build things!

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The lecture

- **Lecture:** by Cristina Benea-Chelmus, weeks 1-9 (cristina.benea@epfl.ch)
- Where: in CM 1 Mondays 13:15-14:00 (first class: 17.02.2025)

Lecture material:
You will be provided with these slides and typeset lecture notes that contain derivations performed in class. The lecture notes provide more extensive explanations.

I nevertheless strongly recommend that you take notes during class.

Geogebra:
We gain some additional understand through interactive exercises, e.g. using geogebra

Ed:
This is the best place to ask questions and get answers from teachers. This is also a place to interact with peers. I strongly recommend that students answer questions they feel confident answering.

Content

- 1. Recap Electrotechnique-I
  - What is a resistor, capacitor, and inductor?
  - How do they behave as a function of frequency? Why so? How can we explain this intuitively?
- 2. Frequency-behavior of electronic circuits.
  - How can we represent inductances and admittances in the complex plane?
  - What does this teach us about phase relationship between current and voltage?
- 3. Three-phase systems.
  - Why do we care about three-phase systems? Why are they so special that nations worldwide adopted them?
- 4. Time-dependent systems.
  - What happens if an RC/RL systems is turned on? Why do we care and how can we explain this intuitively?

Organisation of the written notes

Chapter title

Recap Electrotechnique-I

This chapter reviews the most important concepts that you have studied during Electrotechnique-I and will be relevant to Electrotechnique-II.

Key questions:

- What is an electrical current? What is a voltage?
- What happens on the plates of a capacitor?
- What happens inside an inductor?

Key concepts:

- Equations: Kirchhoff's first and second law (junction rule and loop rule).
- Physical quantities: resistance, inductance, capacitance, impedance, admittance.
- Representation of impedances/admittances in the complex plane.

Key equations: capacitance, inductance

Literature: M. Jufer and Y. Perriard, "Electrotechnique", chapters 1-5

Brief motivation

What you need to take away from the lecture

Use these concepts to explain/reason

Where to read further

The exercise class

- **Exercise:** analytical exercises to deepen understanding of subjects treated in class.
- Where: in CM 1 Mondays 14:15-15:00 (first class: 17.02.2025)

Exercise material:
Consists of 1-2 analytical exercises.

Philosophy:
You derive by yourself further characteristics of the circuits we will treat.

Lab sessions

- **Labs (weeks 10-13):** hands-on, practical exercises to deepen acquired knowledge
- Who: Philippe Allenbach philippe.allenbach@epfl.ch
- Where:
  - Lab 1: Time-dependent systems, Mondays 13:15-16:45, MED 22519
  - Lab 2: Three-phase systems, Fridays 12:15 – 15:45, ELD 040

  (based on student registrations)
- More info will follow from Philippe Allenbach

The exam preparation

- **Exam:**
  - final written exam which counts for 80% of the grade
  - and a multiple choice exam about the practical lab work which counts for 20% of the grade, organized in the last week of the semester (week 14).

- **Preparation:** each chapter contains key questions that you need to be able to answer at the end of the semester.

About us

- Me:
  - Leading Hybrid photonics laboratory (HYLAB): https://www.epfl.ch/labs/hylab/
  - We study integrated circuits that combine electronics with photonics, fabricate them and measure their properties in the lab.

- Your TAs:
  - Yazan Lampert yazan.lampert@epfl.ch
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  - Tim Vial tim.vial@epfl.ch

Material

Microengineering (MT) / MT - Bachelor

Electrotechnics II

Course Settings Participants Grades Reports More

General

Collapse all

Classroom teaching (weeks 1-9)

Teacher and examiner: Prof. Dr. Cristina Benea-Chelmus

Class: Mondays 13:15-14:00 in CM 1

Exercise: Mondays 14:15-15:00 in CM 1

Office hours: Throughout weeks 1-9, Fridays from 11:00-13:00, BM3138

Contacts: Cristina Benea-Chelmus cristina.benea@epfl.ch & Yazan Lampert yazan.lampert@epfl.ch

Practical work (weeks 10-13)

Teacher and examiner: Philippe Allenbach

By the end of the course

You should know:

- How the most basic electronic components work and what happens if we assemble them together. Use simple formulas to support your arguments.

- What kind of interesting electronic systems have emerged from assembling together and why are they relevant:
  - Switches
  - Lumped elements
  - Sources

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