Course syllabus

Digitalteknik
Design of Digital Circuits - A Systems Approach

EITF65, 9 credits, G2 (First Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED C/D
Date of Decision: 2023-04-18

General Information

Main field: Technology.
Compulsory for: D2, E2
Elective for: BME4, C4, F4, Pi4
Language of instruction: The course will be given in Swedish

Aim

The aim of the course is to give basic knowledge about digital systems. Especially the ability to construct and analyse models is emphasised.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to identify and formulate problems within the area of digital circuit switching.
- be able to classify the level of difficulty of problems related to the his/her own level of knowledge.
- be able to model digital systems of low complexity by use of state transition graphs.
- be able to analyse and describe digital systems of low and medium high complexity.

Competences and skills
For a passing grade the student must

- be able to realise digital systems of low and medium high complexity with digital circuits.
- be able to show ability to handle new concepts, methods and results.

Judgement and approach
For a passing grade the student must

- be able to show insight concerning possibilities and limitations of digital systems.

Contents

Introduction. States and state spaces are important concepts for construction of digital systems. Examples from different areas illustrate how these concepts leads to a formalisation of informal problem descriptions.

Basics. The base for all constructions with digital circuits is the Boolean algebra. This is introduced from abstract algebra and Boolean rings. Some important theoretical concepts of Boolean functions are discussed. Special Boolean functions, linear and affine functions, and applications within logic is presented.

Combinational circuits. Realisations of, for example, the next state function in sequential circuits involve constructions of combinational circuits with one or several outputs. Methods for circuit realisations and minimisation are discussed. Different applications are studied and specific problems that arise, for example delay, is mentioned.

Sequential circuits. Synchronous sequential circuits are introduced as a way to realise the behaviour of the state transition graphs. Aspects like state assignments and state minimisation is discussed.

Linear sequential circuits. Linear sequential circuits are of special interest in many applications. A richer algebraic structure allows more powerful methods for constructions. Canonical forms, controllability, and observability is discussed together with analysis of linear feedback shift registers.

Modern digital design: Basics on how gates and other components are constructed on transistor level and a brief introduction to tools for digital design using a hardware describing language, for example VHDL. Basic syntax in a hardware describing language.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Examination through approved labs part, a written exam and home assignments.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts
Code: 0117. **Name:** Examination.
Credits: 4,5. **Grading scale:** TH. **Assessment:** Written exam. **Contents:** The whole course. **Further information:** Written exam after ht1.
Code: 0217. **Name:** Laboratory Work.
Credits: 4,5. **Grading scale:** UG. **Assessment:** Passed laboratory lessons. **Contents:** The course has five mandatory laboratory sessions. The last one is double work compared with the others. The lab part also includes a final mandatory test (moodle).

Admission

The number of participants is limited to: No
The course overlaps following course/s: EIT020

Reading list

- Johannesson R, Smeets B J M: Design of Digital Circuits---A Systems Approach. (Sold by KFS.).
- Laborationer i Digitalteknik, published by the department. (Sold by KFS.).

Contact and other information

Course coordinator: Per Andersson, per.andersson@eit.lth.se
Course homepage: http://www.eit.lth.se/course/eitf65
Further information: The course is given in Swedish, but some parts can be given in English.