

# Signal Processors

## Lecture Notes, Pt 0

Institut für Technische Informatik, DI Dr. Eugen Brenner  
Signal Processors, 448.032

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# Organisation

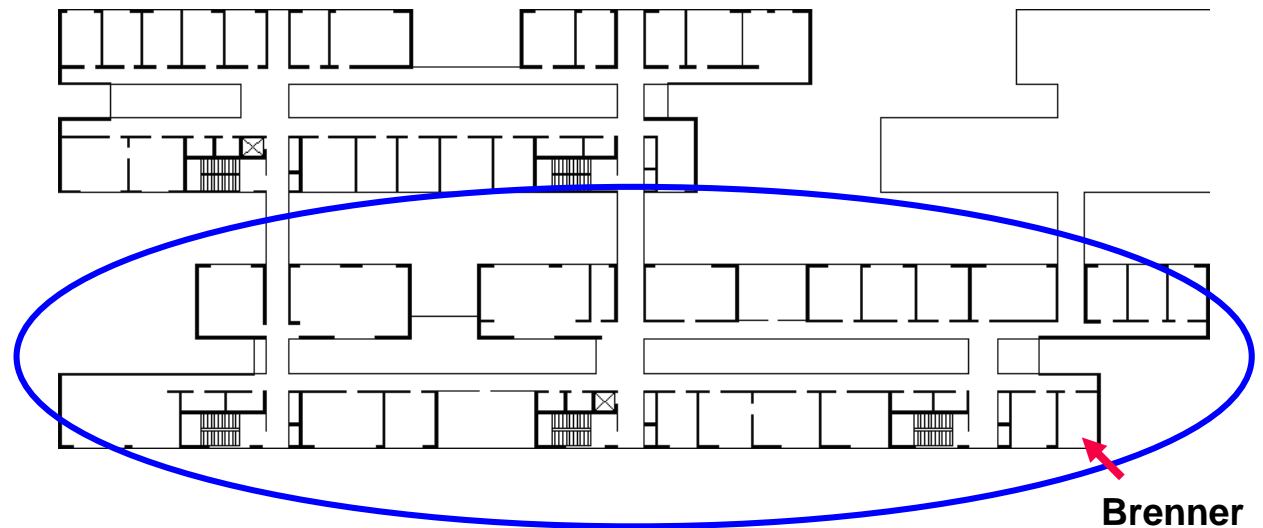
Lecturer:

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# Syllabus

- Microprocessor fundamentals
- Digital Signal Processors
- DSP development cycle, DSP programming
- Code Optimization
- Examples of DSPs

# Attendance & Lecture Notes

- Attendance formally not required
- Reasons for coming anyway
  - Fill the provided slides with meat
  - Get better grades
  - It's more fun
- Lecture notes are available on TeachCenter

# Schedule

- Wednesday 10:00 – 12:00

*Changes will be entered in TUG Online or via e-mail  
(short-term)*

# Organizational: Exams

- Topics discussed in the lecture
  - Written exam
  - $\geq 50\%$  to pass
  - Time: 60 min
  - No documents allowed
  - *Optional*: student presentations

# Student Presentations

- Choose topic of interest
  - Write a paper about the topic
  - Prepare short presentation
  - Can be done in groups of max. 3 people
  - Zero tolerance in case of plagiarism
- Get up to 8 bonus points on the written exam

# Topics for Student-Presentations

- Other DSP platforms
- DSPs in ...
  - Wireless Sensor Networks / IoT
  - Embedded Systems, mobile devices
- Code optimization
- DSPs and Power management
- DSPs in SoC
- Coprocessors for DSPs
- Building an instruction set
- . . .



# Chapter Overview

## 1. Microprocessor Fundamentals

- Processor & Programming Models
- Performance Criteria
- Data Path Implementation
- CISC vs. RISC
- Superscalar Processors
- Very Long Instruction Word Processors (VLIW)
- Detour: Programming Model / Program Execution
- Out-of-Order Execution
- Memory System
- Direct Memory Access
- Conclusion

# Chapter Overview

## 2. Fundamentals of DSP

- Motivation
- Examples of DSP Applications
- Characteristics of DSP Algorithms
- HW Features of DSPs
- Components of DSP Architectures
- Characteristics of DSP Architectures
- Selected DSP Implementations
- Number Formats
- DSPs vs. General Purpose CPUs
- Conclusion

# Chapter Overview

3. Development of DSP Systems
  - DSP Software Development Process
  - Modelling of DSP Systems
  - Algorithm and Architecture
  - Software Architecture – DSP/BIOS
  - Conclusion

# Chapter Overview

4. DSP Platforms & Performance Criteria
  - Performance Criteria
  - Texas Instruments DSPs
  - Alternative Platforms
  - Comparison
  - Conclusion

# Chapter Overview

## 5. Code Optimization

- Introduction
- TMS320C6000 Architecture
- Optimize C Code
- Assembler Optimization
- Software Pipelining
- Meeting Real-Time Requirements
- Conclusion

# Literature

- Gerhard Doblinger: **Signalprozessoren**  
J. Schlembach Fachverlag, 2000 (Link: UB TUG)
- Kai Hwang: **Advanced Computer Architecture**  
MIT Press and McGraw-Hill, Inc., 1339 (Link: UB TUG)
- Matthias Menge: **Moderne Prozessorarchitekturen**  
Springer Verlag, 2005. (Link: UB TUG) (E-Book)
- Andrew S. Tanenbaum: **Structured Computer Organization**  
Prentice Hall, 2006. (Link: UB TUG)
- Sen M. Kuo and Woon-Seng Gan: **Digital Signal Processors**  
Pearson Prentice Hall, 2005. (Link: UB TUG)
- Philip D. Lapsley: **DSP processor fundamentals: architectures and features**  
Berkeley Design Technology Inc, 1994. (Link: UB TUG)

# Signal Processors, Laboratory

- Will take place after the Easter break
- Work in groups of 2
- 4 different exercises
  - Getting started: working alone (1 week)
  - 3 supervised exercises (attendance mandatory)
- 2 groups
- Delivery: Lab report for every group