

Lecture

## **Music Processing Analysis (MPA)**

# **Introduction**

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# Meinard Müller



- Mathematics (Diplom/Master)  
Computer Science (PhD)  
Information Retrieval (Habilitation)

**Bonn University**



- Combinatorics (Postdoc)

**Keio University, Japan**



- Senior Researcher

**Max-Planck Institute, Saarland**



- Professor: Semantic Audio Processing

**Erlangen-Nürnberg University**



# Group Members

- Christof Weiß
- Frank Zalkow
- Michael Krause
- Sebastian Rosenzweig
- Yigit Özer



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Where are we?

# Where are we?



## Fraunhofer-Gesellschaft

- Europe's largest organization for applied research
- 18,000 employees worldwide, total budget: 1.5 billion €
- 60 institutes covering a broad range of research areas

## Fraunhofer Institute for Integrated Circuits IIS

- Largest Fraunhofer institute
- Staff >700 people
- MP3



# Where are we?



## Friedrich-Alexander Universität Erlangen-Nürnberg (FAU)

- One of Germany's largest universities
- More than 35,000 students



## Collaboration between FAU and Fraunhofer IIS

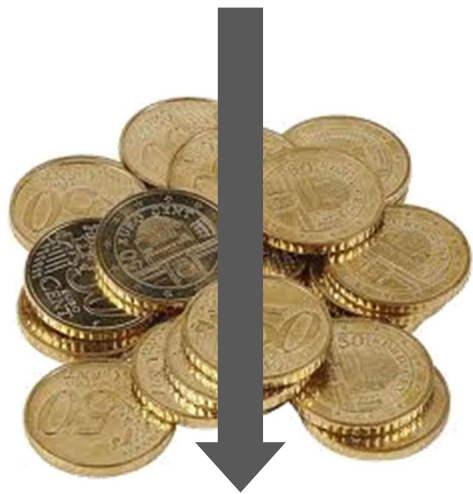
- Roots of “MP3” audio compression scheme
- Research on audio coding in Erlangen since 1981

# International Audio Laboratories Erlangen

 **Fraunhofer**  
IIS



**FAU** FRIEDRICH-ALEXANDER  
UNIVERSITÄT  
ERLANGEN-NÜRNBERG



**AUDIO**  
**LABS**



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# International Audio Laboratories Erlangen



**Audio**

# International Audio Laboratories Erlangen

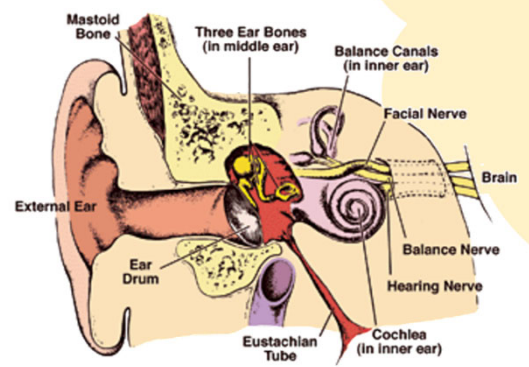
Audio Coding



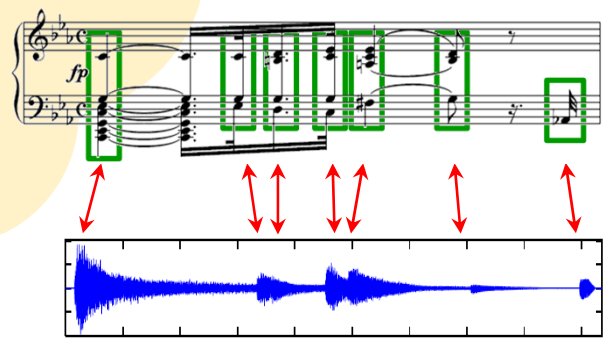
3D Audio



Audio



Psychoacoustics



Music Processing

# AudioLabs – FAU

- Prof. Dr. Jürgen Herre  
Audio Coding
- Prof. Dr. Bernd Edler  
Audio Signal Analysis
- Prof. Dr. Meinard Müller  
Semantic Audio Processing
- Prof. Dr. Emanuël Habets  
Spatial Audio Signal Processing
- Prof. Dr. Frank Wefers  
Virtual Reality
- Prof. Dr. Nils Peters  
Audio Signal Processing
- Dr. Stefan Turowski  
Coordinator AudioLabs-FAU



# Related Courses

## Audio Processing **Laboratory**

The objective of this lab course is to give students a hands on experience in audio processing.

- Offered every semester
- Short-Time Fourier Transform
- Speech Enhancement
- Statistical Methods
- Speech Analysis
- ...

Registration via StudOn is mandatory!

## Audio Processing **Seminar**

Various applications within audio and acoustic signal processing.

- Offered every semester
- Advanced topics
- Require lecture on DSP, audio, ...
- Also music-related topics
- ...

Registration via StudOn is mandatory!



Registration on studOn is mandatory!

# Related Courses

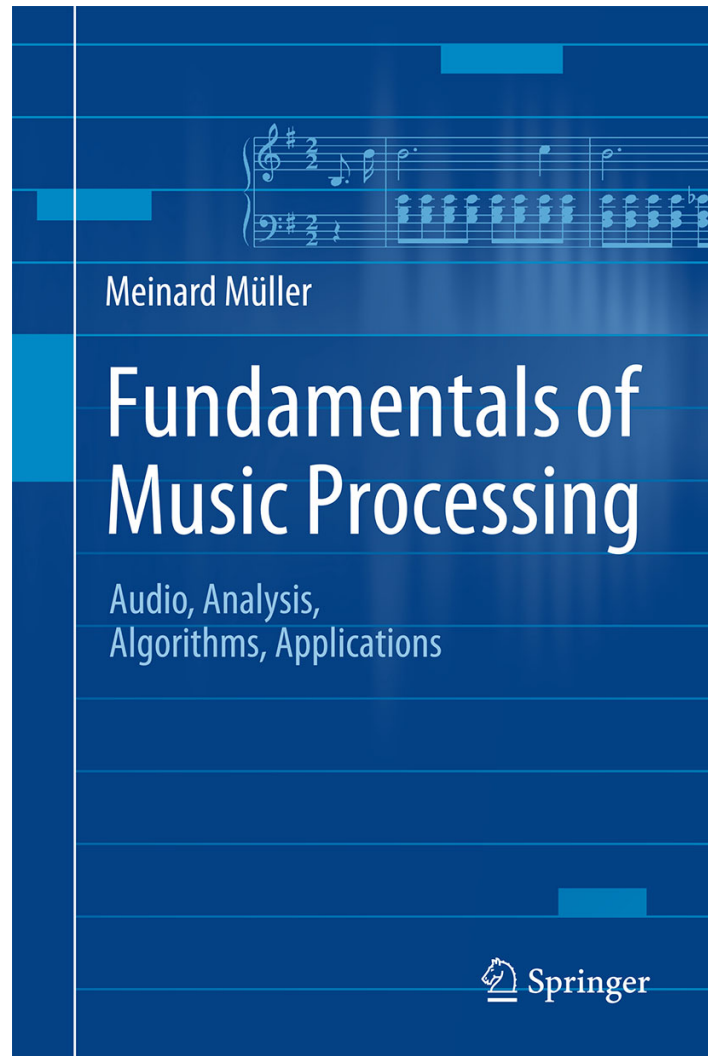
- **Speech Enhancement**  
Prof. Dr. Emanuël Habets  
AudioLabs
- **Advanced Topics in Perceptual Audio Coding**  
Prof. Dr. Jürgen Herre  
AudioLabs
- **Music Processing – Synthesis**  
Maximilian Schäfer (Prof. Dr.-Ing. Rudolf Rabenstein)  
Lehrstuhl für Digitale Übertragung (LMS)

# Lecture: Music Processing Analysis (MPA)

[https://www.audiolabs-erlangen.de/fau/professor/mueller/teaching/2020w\\_mpa](https://www.audiolabs-erlangen.de/fau/professor/mueller/teaching/2020w_mpa)

- Dates, Material, Information ... → **See website!**
- Time: Mo 16-18
- Mandatory elective course for CME, I&K, EEI, and ASC  
Credits: 2,5 ECTS
- Vertiefungsmodul Informatik (Master of Science)  
Medieninformatik, Mustererkennung  
Credits: 5 ECTS (Lecture & Exercise, MPA-LE)  
Time (Exercise): Mo 14-16
- Oral exam

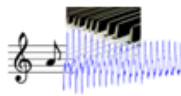

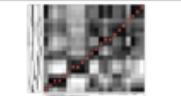
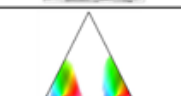

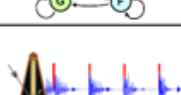


# Book: Fundamentals of Music Processing



Meinard Müller  
Fundamentals of Music Processing  
Audio, Analysis, Algorithms, Applications  
483 p., 249 illus., hardcover  
ISBN: 978-3-319-21944-8  
Springer, 2015

Accompanying website:  
[www.music-processing.de](http://www.music-processing.de)

# Book: Fundamentals of Music Processing

Chapter		Music Processing Scenario
1		Music Representations
2		Fourier Analysis of Signals
3		Music Synchronization
4		Music Structure Analysis
5		Chord Recognition
6		Tempo and Beat Tracking
7		Content-Based Audio Retrieval
8		Musically Informed Audio Decomposition

Meinard Müller

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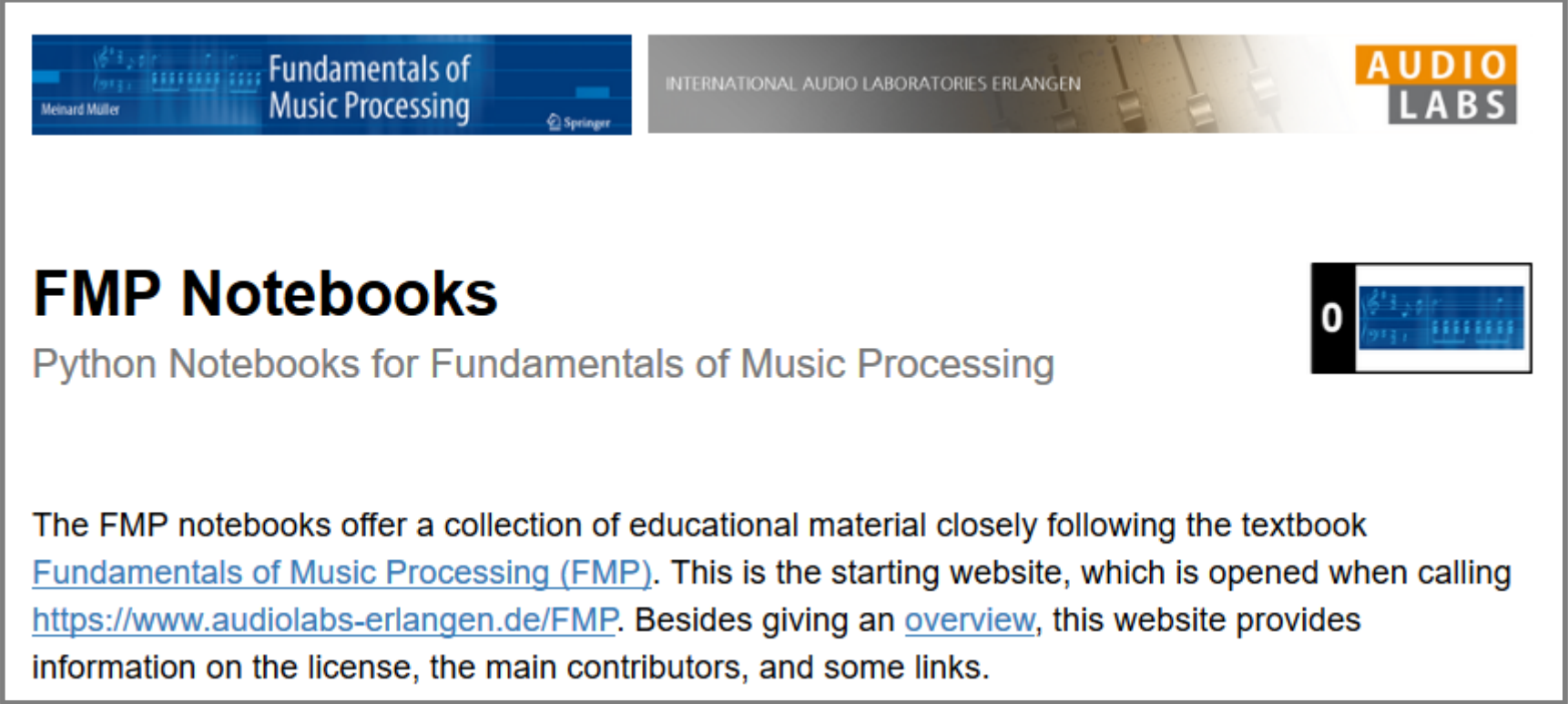
Springer, 2015

Accompanying website:

[www.music-processing.de](http://www.music-processing.de)



# Software & Audio: FMP Notebooks



The screenshot shows the header of the FMP Notebooks website. On the left is the cover of the book 'Fundamentals of Music Processing' by Meinard Müller, published by Springer. In the center is the logo for 'INTERNATIONAL AUDIO LABORATORIES ERLANGEN'. On the right is the 'AUDIO LABS' logo. Below the header, the main heading is 'FMP Notebooks' in a large, bold, black font. Underneath it is the subtitle 'Python Notebooks for Fundamentals of Music Processing'. To the right of the subtitle is a small icon of a notebook with a blue cover and a white page, with a black square containing the number '0' to its left. Below the subtitle is a paragraph of text: 'The FMP notebooks offer a collection of educational material closely following the textbook [Fundamentals of Music Processing \(FMP\)](#). This is the starting website, which is opened when calling <https://www.audiolabs-erlangen.de/FMP>. Besides giving an [overview](#), this website provides information on the license, the main contributors, and some links.'

<https://www.audiolabs-erlangen.de/FMP>