

# A Cross-University Massive Open Online Course on Communication Acoustics

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## INTRODUCTION

Acoustics is a multi-faceted domain and is typically not represented by a dedicated department at academic institutions. Various researchers from the nine large universities of technology in Germany, and from Chalmers University of Technology in Gothenburg, Sweden, have therefore pooled forces to create an open online course on the topic of **communication acoustics** the individual chapters of which are being taught by dedicated experts on the respective topic.

The course is part of the curriculum at four of the contributing universities.

### Communication Acoustics

Communication acoustics is the subdomain of acoustics that deals with the components of systems that are being relevant in the communication between humans, between humans and machines, and between machines.

### Miscellaneous facts

- Access is free (an email address is required for sign-up)
- Target audience: University students at late bachelor or early master level
- Required knowledge: Basic knowledge of the fundamentals of signals and systems
- Platform: edX (<https://www.edx.org/>)
- Duration: 14 weeks (sync'd to the German academic calendar)
- Schedule: Instructor paced, one chapter per week, every winter semester (Oct.-Feb.)
- Established: Fall 2016
- Learner work load: 6-8 hours / week
- No. of presenters: 8



## CONTENTS / CHAPTERS

### Part I – Fundamentals

- Fundamentals of Acoustics
- Fundamentals of Signal Processing
- Anatomy and Physiology of the Hearing System
- Psychoacoustics
- Electroacoustics
- Speech Acoustics

### Part II – Applications

- Sound Recording and Reproduction
- Virtual Acoustics: Binaural Technology
- Virtual Acoustics: Sound Field Analysis and Synthesis
- Room Acoustics 1 and 2
- Automatic Speech Recognition
- Text-To-Speech Synthesis
- Psychoacoustics in Product Development
- Product Sound Design
- Perceptual Audio Coding

## EXAMS

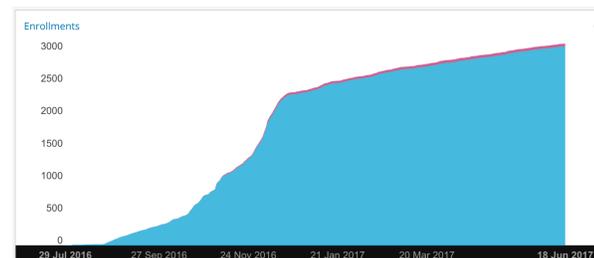
### Online

All enrolled learners can participate in a 60-minute final exam that takes place two weeks after the end of the course. Verified (i.e. paying, \$49) learners receive a personalized certificate. The online exam is repeated until all verified learners have passed. The profit is distributed amongst the contributing organizations.

### At the universities

The course is part of the curriculum at the four contributing German universities (TU Berlin, RWTH Aachen, TU München, TU Dresden). Time-sync'd written (pen and paper) on-site exams are performed at each of the universities to be able to comply with the different legal requirements. The exam problems are identical at all locations.

## ENROLLMENT FIGURES



The internal (non-public) course started on October 15, 2016, with approx. 200 learners. The public course started on Dec. 05, 2016, with approx. 2300 learners (42 verified). There were more than 200 active learners at the end of the course. This corresponds to 7.8 % (average on edX: 5 %).

## LEARNING MATERIALS

### Videos

Video clips are the basis of the course. There are 77 clips with a total duration of 890 min available (distributed over 16 chapters). The durations of the clips vary between a few minutes and approx. 30 min. The videos are complemented by texts and sound examples.

### In-line quizzes

At various locations in the course, there are electronic quizzes and other gamified tasks available to the learners to re-cap the content. Examples are:

- Multiple choice questions
- Drag-and-drop tasks
- Small mathematical assignments

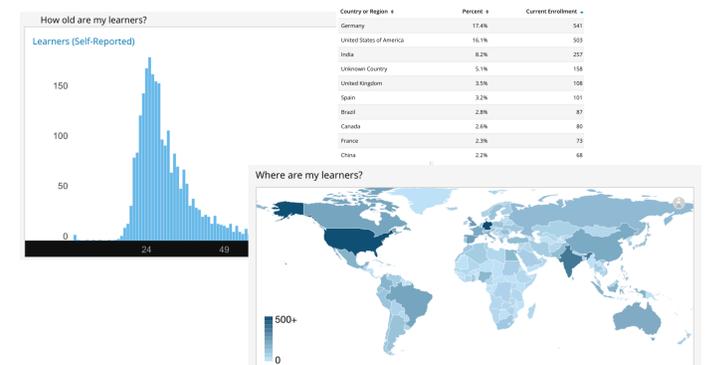
### Home assignments

Each chapter concludes with a home assignment with a work load of approx. 3 hours. Example assignments:

- Matlab /Octave programming assignments
- Short essays
- Mathematical assignments

All assignments have to be uploaded to the MOOC platform one week after the corresponding chapter closes. Those assignments that cannot be graded automatically are graded via learner peer-review.

## DEMOGRAPHICS AND GEOGRAPHICS



## LESSONS LEARNED

- The creation of non-copyrighted materials is a massive effort
- Not all contributors deliver on time
- Not all contributors put the same amount of effort
- The discussion forum does not maintain itself (many questions require a staff member's response)
- Sample solutions for any sort of assignment are a must
- We did not reach the critical mass of learners required for a reliable peer-review
- Advertisement of the course is critical

## ONGOING IMPROVEMENTS

- The course will be split into two courses (**Fundamentals** and **Applications**) with a duration of 7 weeks each
- Ongoing polishing of the contents, especially alignment of the information density
- Incorporation of learner feedback from the discussion forum
- Creation of electronic on-site exams that are lawful

## ALTERNATIVE USES OF THE COURSE

We are aiming at creating a "timeless" and comprehensive course that can serve as a learning resource in all sorts of situations. It is already being used, for example, at the University of Applied Sciences in Cologne, Germany, as individual training for PhD students or master's students who need to catch up with some the content.

<https://www.edx.org/course/communication-acoustics-rwthx-ca101>

