

MAT 240C Digital Audio Programming

Events and Interactive Control

T-TR 12-2, 4 Units

Music 2215

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Lab/TA Office Hours TBA

An indispensable aspect of audio programming in interactive systems is providing real-time control. This entails being able to receive and interpret data coming from physical interfaces and applying it to audio parameters. There are various widespread technologies like MIDI and OSC that enable this, as well as many challenges related to performance, timing and concurrency.

This course will present a low level approach to these technologies to understand what's needed to integrate them in practical software, as well as a look into the natural extensions of interactive control, like network performance and distributed processing.

Pre-requisites

Students are expected to have attended MAT 240A and MAT240B, or should have some familiarity of C, C++ and of digital audio. This course, however, will cover practical aspects related to building and developing applications, so extensive programming experience is not required.

Topics

- MIDI
- OSC
- Serial protocols
- Distributed processing
- Control from GUI toolkits

Software

The software used throughout this course will be the C and C++ languages. Examples will be demonstrated using the QtCreator frontend and the Cmake build system for cross-platform compilation.

You are encouraged to install the software discussed in this course on your own machine, as all of it is cross-platform and free/libre software.

Tentative Schedule

Week 1

The MIDI Protocol
Using MIDI in software
Using control blocks

Week 2

MIDI APIs
MIDI files
Realtime MIDI

Week 3

MIDI Clock and MIDI Time Code
MIDI in audio plugins
MIDI over IP
Threading and concurrency: blocking vs. callback interfaces

Week 4

OSC protocol
OSC in practice

Week 5

OSC libraries
Lock-free message queues

Week 6

Control and interface.js
OSC applications

Week 7

Control from serial devices like Arduino.

Week 8

Distributed processing
Networked synthesis and performance

Week 9

Control from GUI toolkits

Week 10

Final projects

Final project

Students will prepare a final project where they explore some technique studied in the course, or some other related technique to produce a practical or artistic application.

Grading

40% Homeworks

50% Final project

10% Attendance and participation

References and Resources

Boulanger and Lazzarini, eds. The Audio Programming Book. MIT Press. 2011.

Roads. The Computer Music Tutorial. MIT Press. 1996.