

Professor Guerino Mazzola

Fall 2019. MUS 5591, Ferg 81: *Introduction to Music Information Technology*

Course Description

Introduction to Music Information Technology is a first introduction to some basic concepts, theories, and hard- and software technologies regarding music. We first discuss the nature of sound and its most famous synthesis methods: Fourier, Frequency Modulation, Wavelets, and Physical Modeling. We then discuss the digital encoding and decoding of sound and related file formats with their compression, and in more detail MP3. After this sound-oriented discourse, we look at symbolic encoding, mainly MIDI and associated soft- and hardware. We then have a more systematic look at a number of audio and MIDI software, including Audacity, GarageBand, Live, Logic, Sibelius/Finale, and Max. However, this is not a course on one of these software, we shall just try to work with them in order to see how they implement audio and MIDI encoding of sound. We terminate the course by a short discussion of the technology of global music.

Media and Collaboration

Powerpoint slides, audio and MIDI software, blackboard discussions (important!). Collaboration with students essential.

Prerequisites

Instructor's consent, but most importantly the willingness to understand how sound and symbolic music data are encoded and implemented in various software environments.

Goals and Objectives

The three principal objectives: (1) to understand how sound and notes are structured, (2) how these structures are encoded in analog and digital concept frameworks, and (3) how these concept frameworks are implemented in various commercial software environments.

The goal of this course is also to work together to understand creativity in music technology, this was also a topic of my course on musical creativity in Spring 2012, and it is described in detail in my book **Musical Creativity—Strategies and Tools in Composition and Improvisation**, by Springer (in the book series *Computational Music Science*).

Grading

I grade on a scale 0-10 with 0.1 steps: 9.5-10 = A, 9-9.4 = A-, 8.5-8.9 = B+, 7.6-8.4 = B, 7-7.5 = B-, 6.5-6.9 = C; 6-6.4 = C-, 5-5.9 = D, 0-4.9 = F.

We make a Finite Fourier theory test and

we have three presentations, each given (ideally) by a group of two students.

1st in-class presentation due October 02/04/07, length = 20 minutes.

2nd in-class presentation due October/November 30/01/04, length = 20 minutes.

3rd in-class presentation due December 02/04/06/09, length = 40 minutes.

Final grade: Class participation 30%, Fourier test 10%, first presentation 15%, second presentation 15%; third presentation 30%; no final exam.

Plagiarism will not be tolerated and will lead to failure.

Contact

My office hours are by appointment (room 164).

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Schedule of Classes

I Introduction and ontology

| | | |
|-----------------|--------------|------------------------------------|
| I.1 (W Sep 04) | Introduction | Introduction and overview |
| I.2 (Fr Sep 06) | Introduction | The ontology of music |
| — | | |
| I.3 (M Sep 09) | Introduction | Discussion of ontology by examples |

II Acoustic Reality

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|-------------------|------------------|--------------------------------------|
| II.1 (W Sep 11) | Acoustic Reality | Sound |
| II.2 (Fr Sep 13) | Acoustic Reality | The communicative dimension of sound |
| — | | |
| II.3 (M Sep 16) | Acoustic Reality | Fourier |
| II.4 (W Sep 18) | Acoustic Reality | FM, Wavelets, Physical Modeling |
| II.5 (Fr Sep 20) | Acoustic Reality | Examples via Audacity SW |
| — | | |
| II.6 (M Sep 23) | Acoustic Reality | Examples: Simple waves |
| II.7 (W Sep 25) | Acoustic Reality | Examples: Noise, envelopes |
| II.8 (Fr Sep 27) | Acoustic Reality | Examples: Own recordings |
| — | | |
| II.9 (M Sep 30) | Acoustic Reality | Examples: Spectra, Tuning, FM |
| II.10 (W Oct 02) | Acoustic Reality | Assigned presentations 1 |
| II.11 (Fr Oct 04) | Acoustic Reality | Assigned presentations 1 |
| — | | |
| II.12 (M Oct 07) | Acoustic Reality | Assigned presentations 1 |

III Electromagnetic encoding of music: Audio HW and SW

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|--------------------|-----------------|--|
| III.1 (W Oct 09) | Audio HW and SW | General picture of analog/digital sound encoding |
| III.2 (Fr Oct 11) | Audio HW and SW | LP and tape technologies, some history |
| — | | |
| III.3 (M Oct 14) | Audio HW and SW | The digital approach, sampling |
| III.4 (W Oct 16) | Audio HW and SW | Finite Fourier analysis |
| III.5 (Fr Oct 18) | Audio HW and SW | FFT |
| — | | |
| III.6 (M Oct 21) | Audio HW and SW | MP3, MP4, AIFF |
| III.7 (W Oct 23) | Audio HW and SW | Examples of compression |
| III.8 (Fr Oct 25) | Audio HW and SW | Filters, EQ, Reverb |
| — | | |
| III.9 (M Oct 28) | Audio HW and SW | Time and pitch stretching |
| III.10 (W Oct 30) | Audio HW and SW | Assigned presentations 2 |
| III.11 (Fr Nov 01) | Audio HW and SW | Assigned presentations 2 |
| — | | |
| III.12 (M Nov 04) | Audio HW and SW | Assigned presentations 2 |

IV Symbolic Formats: Notes, MIDI, Denotators

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| IV.1 (W Nov 06) | Symbolic Formats | Western notation and performance |
| IV.2 (Fr Nov 08) | Symbolic Formats | MIDI: what it is about, short history |

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|---|------------------|--|
| — | | |
| IV.3 (M Nov 11) | Symbolic Formats | MIDI networks: MIDI devices, ports, and cables |
| IV.4 (W Nov 13) | Symbolic Formats | MIDI messages: hierarchy and anatomy |
| IV.5 (Fr Nov 15) | Symbolic Formats | Time in MIDI, MIDI Standard files |
| — | | |
| IV.6 (M Nov 18) | Symbolic Formats | Short introduction to Denotators |
| V <i>SW Environments for MIDI and Audio</i> | | |
| V.1 (W Nov 20) | Symbolic Formats | Short introduction to Denotators and Rubato |
| V.2 (F Nov 22) | SW Environments | Rubato |
| V.3 (M Nov 25) | SW Environments | Rubato/BigBang Rubette |
| V.4 (W Nov 27) | SW Environments | Summary of course |
| Thanksgiving | | |
| — | | |
| V.5 (M Dec 02) | SW Environments | Assigned presentation 3 Steinway Player Piano |
| V.6 (W Dec 04) | SW Environments | Assigned presentation 3 Reason |
| V.7 (Fr Dec 06) | SW Environments | Assigned presentation 3 MaxMSP |
| VI <i>Global Music</i> | | |
| — | | |
| VI.1 (M Dec 09) | Global Music | Assigned presentation 3 Rubato Composer |
| VI.2 (W Dec 11) | Global Music | Concluding observations and discussion |

Selected Original References

Audacity software: <http://audacity.sourceforge.net>

Dan Hosken: Introduction to Music Technology. Routledge, New York and London 2nd ed. 2015

Curtis Roads: The Computer Music Tutorial. MIT Press Cambridge Mass. and London 1998

Curtis Roads: Composing Electronic Music. Oxford U Press, New York City 2015

Guerino Mazzola: The Topos of Music. Birkhaeuser, Basel 2018

Guerino Mazzola et al: Elemente der Musikinformatik. Birkhaeuser, Basel 2006

Guerino Mazzola et al: Musical Creativity. Springer, Heidelberg 2011

Guerino Mazzola et al: Basic Music Technology. Springer, Heidelberg 2017

Guerino Mazzola et al: <http://www.rubato.org>

Powerpoints and other materials are on my homepage: <http://www.encyclospace.org>